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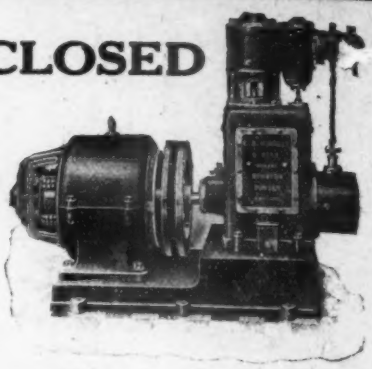

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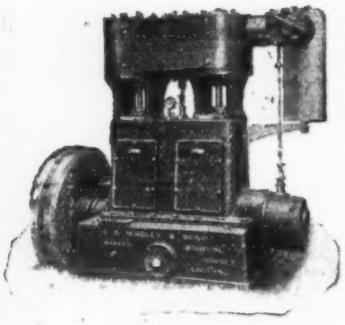

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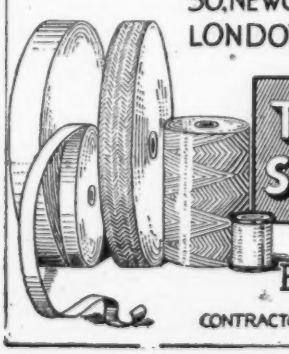

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VOL. LXXXI. DECEMBER 14, 1917. No. 2,090.

ELECTRICAL REVIEW.

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MACHINERY FOR THE WORK OF RECONSTRUCTION.

THE reports of the removal by the common enemy of all kinds of machinery and plant from Belgium and the occupied districts of France have been so frequent during the past two years that it is impossible to disbelieve them, and it may therefore be assumed that almost everything which can be utilised by the enemy has been, or will be, seized or destroyed in order to prevent the return to the rightful owners of property which could be advantageously used by the Allies, and also in connection with the gradual military advance. On the other hand, some machinery and plant may have been destroyed or greatly damaged by inadvertence through the gun-fire of the Allies in the promotion of the forward movements, as it is not possible absolutely to prevent incidents of this kind. In any case, the devastation caused to property by the war has been enormous, and will necessitate a stupendous expenditure for the work of restoration after the conclusion of peace. What this outlay may approximately amount to it would be exceedingly difficult for us to determine, but the leading iron and steel interests in the United States have not been deterred from making an inquiry into the situation, or from the formulation of estimates which are based upon an investigation made by a committee which paid a visit to Europe in the autumn of last year.

The report prepared by the committee was presented at a meeting held at Pittsburg. It shows that, in the opinion of the committee, the reconstruction requirements owing to the destruction of public and private property would represent an aggregate of £1,200,000,000 in the case both of the western and eastern fronts, £750,000,000 applying to the former and £450,000,000 to the latter. Apart from buildings, raw materials, and manufactures, the report calculates that it would be necessary to expend a total of £270,000,000 on industrial machinery in Belgium and France, £12,000,000 on agricultural machinery and implements, and £85,000,000 on railways, bridges, and tramways. If the figures for the two countries are considered in detail, the restoration of the coal and iron ore industries would involve an expenditure of £60,000,000, the iron and steel and metal industries one of £75,000,000, the chemical industry £8,000,000, and the electrical industry £36,000,000, apart from the separate outlay for the textile, paper, wood, and furniture branches. It is assumed that Belgium alone will have to import industrial machinery to the value of from £20,000,000 to £24,000,000, or six times more than corresponding imports in peace times, whilst France herself will probably be able to produce three-fourths of her own requirements in machinery, leaving one-fourth, or the value of £12,000,000, to be procured from abroad in the first year of peace. In the case of Germany, it is computed that the country will be under the necessity of importing machinery worth £6,000,000 per annum in the first years of peace; Galicia is put at £4,000,000, and Poland at £49,000,000 for works and machinery.

The foregoing estimates, as previously mentioned, only apply to the autumn of 1916. Since

then, however, the further havoc which has been made would naturally imply a formidable addition to the aggregate figures. Apparently on the assumption that the machinery and plant would be obtained exclusively from the United States, the American interests calculate on the flotation there of a great reconstruction loan by means of which gold shipments would be avoided, and the rates of exchange in Europe be but slightly influenced. On the other hand, a Zurich newspaper, which is published in German, states that it is an open question whether the reconstruction of the destroyed districts will proceed quite according to the American programme. With the entrance of the United States into the war that country also assumed enormous war burdens, and changed over her industries to war work to a far greater extent than previously. As a consequence, the Swiss-German newspaper submits that the United States will in no respect be able so promptly to compete after the conclusion of peace as was assumed by the committee, and that it remains to be seen whether the Americans will be able to offer machinery in countries of the European Allies at prices which would secure the business. On the other hand, the newspaper expresses the hope that Swiss engineering firms, particularly the electrical industry, will find specially favourable prospects open to them for the export of machinery and plant.

It is quite obvious that any estimates concerning the reconstruction of the devastated countries are of no practical value at the present moment. At the same time, it has to be borne in mind that the American computations were made prior to that country's participation in the war, and that, therefore, some prospect previously existed that American firms would secure a very considerable amount of the business which will result from the work of restoration. This assumption, however, has been greatly modified by the association of the United States with the common struggle for justice and freedom from the military domination of enemy countries, and under existing circumstances American firms cannot expect to obtain more than their due proportion of the machinery contracts which will come forward on the conclusion of peace, provided that the requisite shipping facilities are available for transport from the United States to Europe.

Literary Style.

Amongst the "Random Reflections" of our valued contemporary, *The Engineer*, last week, we noted with especial interest an essay on a subject which appeals to us, but seldom figures in the technical Press—namely, the use and abuse of the English language. We wonder whether the average engineer fully appreciates the importance to him of the study of English and the cultivation of a good literary style. Often a practical man whose conversation on technical subjects derives from his expert knowledge a peculiar fascination will tell us that he cannot write an article—all unaware that he has already composed it, and that nothing is lacking but the written record of his observations. Such a man might with advantage try the experiment of engaging a stenographer to set down his remarks addressed to a real or imaginary brother engineer whose experience has run along different lines; he would probably be surprised and pleased to find himself the author of a very readable and informative article—which, moreover, would possess a cash value far in excess of the stenographer's fee.

Our confrère attributes the worst faults of composition to two causes: on the one hand an attempt to write too well, and on the other an absolute indifference to the graces of style. The former leads to the introduction, usually misplaced, of flowers of speech, and hackneyed literary clichés or stock phrases, with disastrous effect upon the reader; a plain tale, told in simple Anglo-Saxon, is the best from every point of view, and every superfluous word is a defect. Of the two classes, we prefer the latter; it may be largely due, as our contemporary holds, to the practice of dictation to a shorthand writer (which is not the same thing as the process which we have suggested above, in which the speaker should forget the existence of the stenographer)—but in many cases we think it arises from an impression that it gives a practical and technical air to the work, whereas it is merely slovenly and affected.

Prominent amongst the defects in the latter category are the omission of the definite article, and the use of the expression "the same" (or the barbarity "same," a heinous crime) in place of "it" or "them," as in the sentence, "Take cloth off table and put instrument on same." These offences against good taste and good English are unspeakably horrible, but they are, unfortunately, very commonly committed. That trap for the unwary or inexperienced, the collective noun, to which our contemporary draws attention, is the source of innumerable errors in the daily Press; we also have made it our practice to treat all such nouns as singular, and find that this course almost invariably meets the case, whereas if the plural is used endless difficulties are encountered. Thus, "This committee has commenced its work" is inoffensive; but to say "This committee have," &c., would mean torture to the reader, and "A committee are sitting" is equally unpleasant. The limitations of our space forbid us to refer to the many other literary solecisms which are constantly being met with, and we must conclude by emphasising again the importance of good English to the engineer, as to every other professional man.

The Kinema and Industry.

We were interested recently in an effort that was being made in the States to utilise the kinematograph as a means of popularising industrial, commercial, and other information respecting manufacturing operations—showing how things in common use are made, and under what conditions. Two lecturers of the Bureau of Economics (Washington) were recently lecturing in the U.S.A., with the aid of kinema films, on various Canadian topics, and one of the outcomes expected is the attraction of emigration and capital to Canada. There is a charm or fascination about such a procedure which renders the kinematograph a far more useful popularising medium than mere lecturing or ordinary pictures. The kinema film has proved its applicability to boosting "electrical development" schemes among the general populace in the States. Life and movement have an irresistible effect. How far would it be possible similarly to demonstrate our more prosaic industrial activities in works in the United Kingdom to the great markets of the world where too little is known about our abilities? We have seen electrical factory operations and processes admirably represented by kinema film in London. How far is the idea adaptable or applicable in helping us to inform the world and expand our trade abroad where, at times, quite wrong notions as to our capacity have been held? We attach great importance to the placing of actual British-made machines and apparatus in colleges abroad, where students will in daily operations become familiarised with them, and to the circulation of brochures containing excellent pictures of our manufactories. Is it worth considering whether, where we cannot send permanent exhibits, we can provide a peripatetic film for the edification of students, institutions, chambers of commerce, and so forth, in the great purchasing centres of the world?

THE EDUCATION AND TRAINING OF ENGINEERS.

By "RADIX."

(*Concluded from page* 533.)

One of the most careful thinkers of the last century has told us that "false ideas can be refuted by argument, but by true ideas alone can they be expelled." Whence are "true ideas" to come, and how are they to be inculcated? Surely not by the exercise of the rational faculty alone. What is termed "reason" varies in different individuals, in different races, and in members of the same race in different parts of the world, and under different conditions of life.

Reason—as understood by most of us who do not indulge in philosophical analysis—may perhaps be described as a co-ordination of facts of experience and of inferences and deductions therefrom. To some people "reason" and "common sense" are synonymous terms. At any rate, the "reason" upon which this non-religious age would have us base our ethical ideas is a state of knowledge arising out of experience or the accumulated results of experience. But, clearly, knowledge based upon experience is necessarily subject to modification as experience becomes wider and fuller. How can morality find any permanent basis in reason alone? All attempts to formulate a code of morals upon reason alone have failed, and *must* fail, since the basis is a variable, and not a constant, one.

Bishop Butler seems to have given us about as good a definition as is possible of the fundamentals of morality in the following words:—"For, as much as it has been disputed wherein virtue consists, or whatever ground for doubt there may be about particulars; yet, in general, there is in reality an universally acknowledged standard of it. It is that which all ages and all countries have made profession of in public; it is that which the primary and fundamental laws of all civil constitutions over the face of the earth make it their business and endeavour to enforce the practice of upon mankind: namely, justice, veracity, and regard to common good."

Whence arise the ideas of "justice, veracity, and regard to the common good"? Not from the exercise of reason alone. It is all very well for materialists and other "ists" to say that ages of experience have shown that without due regard to these ideas a community does not prosper. Grant that this be so (although this does not account for the *origin* of these ideas); grant that reason forces one to give an intellectual assent to the truth of this contention; we all know that "there is a wide difference between the formal assent given to a proposition that cannot be denied, and the efficient belief which produces active conformity with it." In the absence of that "efficient belief," what becomes of the intellectual assent? Is it not common experience that the first question a business man (and, for the matter of that, pretty nearly every man) asks himself in regard to any proposition, business or otherwise, is "What am I going to get out of it?" and if he concern himself at all with what the other chap gets out of it, it is only to enable him to see to it that the other fellow gets as little as possible. Justice and the common good, to say nothing of veracity, become quite secondary considerations.

Herbert Spencer—who certainly did not *profess* to be a religious man—acknowledges that "Were it possible forthwith to replace a traditionally-established system of rules, supposed to be supernaturally warranted, by a system of rules rationally elaborated, no such rationally-elaborated system of rules would be adequately operative. To think that it would, implies the thought that men's actions and beliefs are throughout determined by intellect; whereas they are in much larger degrees determined by feeling."

Herbert Spencer seems to imply that the antithesis is a "consummation devoutly to be hoped," but he is wrong, as is also Tennyson when he sings "We have *but* faith; we cannot *know*, for knowledge is of things we *see*." The fact is that the greatest and most certain part of our knowledge is of things we do not *see*. The whole edifice of scientific knowledge is built upon three principles which we only *feel* must be true, and which do not admit of logical proof:—the principle of uniformity in Nature, the principle of identity, and the principle of causality.

Similarly, the recognition of right from wrong, of good and evil, and the ideas of "justice, veracity, and the common good of all" are *felt*, not *known*. Whence this certainty based upon "feeling"?

I do not hesitate to say that, as a result of 30 odd years' experience of men and things on both sides of the Atlantic, there seems to me, philosophically and scientifically, no escape from the conclusion that the origin of the moral sense is to be sought in an "Eternal power not ourselves which makes for righteousness," and that the only satisfactory exposition of Matthew Arnold's abstract conception is to be found in the Christian faith as originally professed by this country.

So long as the great majority of the children of the masses are brought into the world under the conditions now prevailing; so long as the minds of the young are allowed to develop during their most impressionable years in such surroundings and exposed to such influences and examples; so long as the inculcation of the sense of responsibility to God the Creator and Preserver of all mankind is left out of account in the education of the young, so long will the pernicious doctrines of the positivist, the anarchist, and other "ists" continue to flourish and do their deadly work in perverting the morality of humanity.

One word in conclusion. The view is often expressed that if a man conduct his business on the lines of the Sermon on the Mount, he will find himself in the bankruptcy court sooner rather than later.

In a sense this is perfectly true. It is, however, equally true that the sense in which it is true is *not* the sense in which the Founder of Christianity would have men conduct their business. The admonitions in the Sermon on the Mount are counsels of perfection for the individual, and do not apply to the administration of collective justice. If a man smite us on one cheek, we are not enjoined to turn somebody else's cheek to the smiter. A man may be as charitable as he pleases with his own money, but he must not deal with other people's money as he likes. A judge may submit to be swindled and not have recourse to his legal remedy without thereby, even impliedly, sanctioning the swindling act, but he must not, in the exercise of his office, compel those who are swindled to act likewise. Although our Lord never avenged any injury done to Himself, He nevertheless dealt with those who were defiling the Temple in drastic fashion. He did not waste words in argument, but punished the infraction of the moral law, which was subversive of public morality, by overturning the tables of the money-changers and driving out these breakers of the moral law *by force*.

There is a virile, as well as an emotional, side to the Christian religion. The undue predominance of the emotional over the rational is as dangerous—as regards the common good—as the undue predominance of the rational over the emotional.

We should aim by education to bring about that proper equilibrium "between introspective thought and the outer world of action" which involves the

recognition that justice "is a positive, affirmative force, which entails active duties as well as passive rights."

Huxley, who may be termed, at least, an unbiased witness, expressed himself as "seriously perplexed to know by what practical measures the religious feeling, which is the essential basis of conduct, was to be kept up, in the present utterly chaotic state of opinion on these matters, without the use of the Bible"; and in the same essay* he writes: "If I were compelled to choose for one of my children between a school in which real religious instruction is given, and one without it, I should prefer the former."

Unless Mr. Berriman's Committee—or some other authority—recognise and act upon this governing factor as a root principle in education, they will no doubt turn out skilled men, but not "good" men; their efforts will be productive of palliative measures only, for they will not strike at the root of the evil, and no real progress will be made towards the attainment of the goal they have in view.

MODERN ARC LAMPS AND INCANDESCENT LAMPS.

(*Concluded from page* 532.)

Exterior Lighting.—Where out-of-doors lighting is concerned, or the illumination of large workshops, &c., half-watt lamps have to compete with flame arcs, the characteristics of which may be thus summarised :—

—	Open flame arc; carbons side by side.		Enclosed long-hour flame arc; vertical carbons.	
	D.C.	A.C.	D.C.	A.C.
Colour of light	Yellow	Yellow	White	White
Candle-power (mean lower hemispherical)	1,300— 4,000	1,500— 3,600	2,000— 4,000	1,200— 2,500
Watts per m.h.-s.c.p. (lower)	0·24— 0·17	0·16— 0·19*	0·2	0·25— 0·3*
Burning hours; single and double lamps	17 & 35	17 & 35	150	110

* With choking coil.

In other words, the half-watt lamp has to compete with a one-fifth watt lamp, so that where current economy is important owing to the cost of current or other reason, the flame arc has an immense initial advantage. Current efficiency is not, however, everything. The form of the light distribution curve is especially important in exterior lighting, the object being generally to distribute light as uniformly as possible over a wide area—reducing the intensity of illumination on ground near the lamp in order to increase illumination at more remote points between lamps.

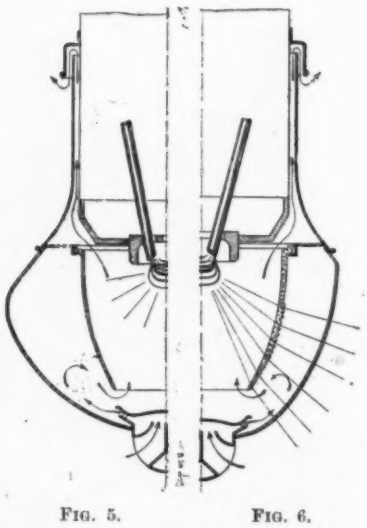


Fig. 5.

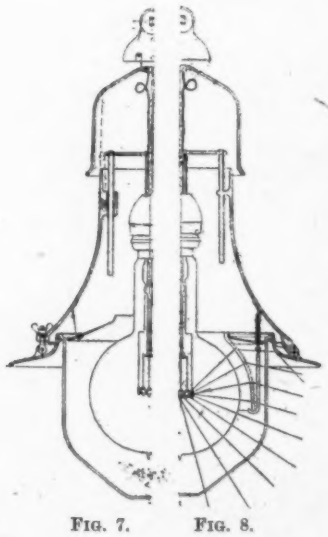


Fig. 6.

Fig. 7.

Fig. 8.

The open flame arc with carbons side by side (fig. 5) does not give a good distribution of light, as regards producing uniform illumination over a wide area. Curve 1 (fig. 9) is the Rousseau curve corresponding to that ideal polar distribution of light which would give uniform ground illumination. The other curves refer to the several types of lamps specified in the "key" adjoining the figure; each curve is reduced to the basis of 500 watts consumption, including ballast in arc lamps, hence the curves are directly comparable. From curve 6 it will be seen that the type of lamp shown in fig. 5 gives a maximum candle-power at 50° or 60° below the horizontal instead of at about 15°. By the addition of a dioptric globe (fig. 6), the polar distribution is improved immensely, and the corresponding Rousseau curve (No. 8, fig. 9) shows quite good approximation to the ideal form. The long-hour enclosed flame arc with vertical carbons also gives a good distribution of light for wide range illumination (see curve 10, fig. 9).

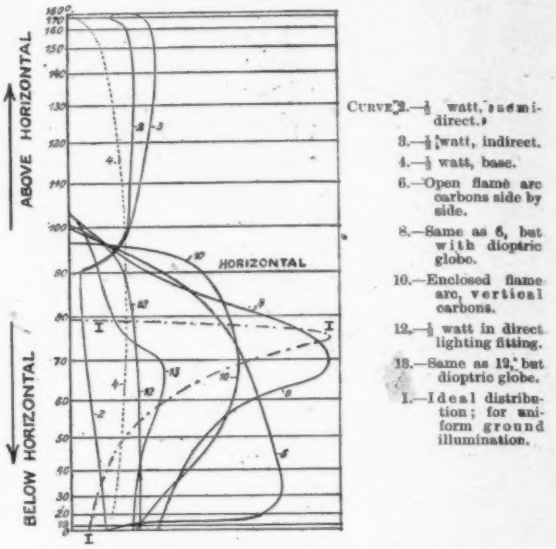

ABOVE HORIZONTAL
BELOW HORIZONTAL
HORIZONTAL
Curve 2.—½ watt, semi-direct.
3.—½ watt, indirect.
4.—½ watt, base.
6.—Open flame arc carbons side by side.
8.—Same as 6, but with dioptric globe.
10.—Enclosed flame arc, vertical carbons.
12.—½ watt in direct lighting fitting.
13.—Same as 12, but dioptric globe.
I.—Ideal distribution; for uniform ground illumination.

Fig. 9.—Rousseau Diagrams for Various Lamps.

Fig. 2 shows the polar distribution from a half-watt lamp in a fitting with enamelled shade (fig. 7), and curve 12, fig. 9, is the corresponding Rousseau diagram. This distribution is good from the point of view of lighting workshops, but a greater proportion of light at 15° to 20° below the horizontal and less at 30° to 90° below the horizontal are needed to provide reasonably uniform ground illumination, using lamps relatively far apart. A dioptric globe (fig. 8) may be used to improve the normal distribution of light, and thus to yield the Rousseau curve 13, fig. 9. About 10 per cent. loss is caused in light passing through a dioptric globe, as compared with 50 per cent. loss in diffuse reflection.

It will be seen that curves 8 and 13 (fig. 9) are similar. In other words, there is little to choose between a vertical carbon flame arc and a half-watt lamp (using a dioptric globe in each case), in point of light distribution. The difference lies in the higher efficiency of the flame arc, already noted.

The areas under the various curves in fig. 9 are propor-

* "The School Boards: What they Can do, and What they May do." (Critiques and Addresses, pp. 50 and 51.)

tional to the total light emitted by the different lamps, and we have here a very clear graphical representation of the relative efficiencies of the lamps as used in practice.

First Cost and Working Cost.—It is important to fix definitely the relative first cost of equivalent arc and half-watt lamp installations, but the difference is generally small. Individual half-watt lamps and fittings are cheap as compared with arc lamps, but more of the former are required in most cases, and there then comes the extra cost of additional wiring, switches and fuses. Part of the ballast resistance needed by arcs may be provided by using the smallest leads consistent with safe temperature rise. Half-watt lamps connected in parallel must, on the other hand, be provided with comparatively heavy leads, in order that the voltage drop may be small.

Carbon costs and the cost of bulb renewals vary with circumstances, but are generally about equal so long as the half-watt lamp fitting protects the bulb from rain and snow without subjecting it to overheating. Cheap, ill-designed fittings waste more by premature lamp failures in a year than they save in first cost, as compared with good fittings.

Attendance costs are lower for half-watt lamps than for arc lamps, but they are not negligible, for the former need a thorough cleaning once or twice a month. Maintenance costs, apart from the bulb and carbon items already considered, are much lower in a half-watt lamp installation than where arcs are used :—

TABLE II.—Total Working Costs of Flame Arc and Half-watt Lamps.

Assuming 1,760 m.h.-s.c.p. and including interest, depreciation, attendance, maintenance and renewals.

Energy cost per unit.	500 burning hours per annum.		3,000 burning hours per annum.	
	Flame arc.	Half-watt.	Flame arc.	Half-watt.
d.	s. d.	s. d.	s.	s.
0·35	45·0	37·3	171	171
0·7	51·0	51·0	220	270
1·18	60·9	71·6	270	377
1·76	73·6	95·0	343	514
2·35	88·0	119·6	415	660

The figures in Table II compare the total working costs (interest, depreciation, carbon and bulb renewals, attendance, and maintenance) for a flame arc lamp and a half-watt lamp, each of 2,000 hefners hemispherical (1,760 h.-s.c.p.), assuming various prices for energy and 500 and 3,000 working hours per annum. Under some conditions the advantage of lower cost lies with the arc ; under others with the half-watt lamp. So it is also with the general merits. Sometimes it is advantageous to have the more powerful units in which arc lamps are obtainable, the yellow light, well penetrating smoke or steam, and the rugged construction, unaffected by vibration and rough handling. Sometimes the glow lamp is chosen on grounds of more convenient wiring, lighter equipment, and easy maintenance by unskilled persons. If the current be very cheap and/or burning hours short, the glow lamp may show, in addition, a saving of money.

The conclusions indicated by these notes are that the gas-filled tungsten lamp is entirely preferable to arc lamps in lighting small and medium-sized interiors, especially where semi-direct or indirect lighting is practised. For lighting open spaces or large, lofty shops, both flame arc and gas-filled tungsten lamps will continue to be used. In such service, both types of lamps have their advantages and disadvantages, and choice can be made only by consideration of individual circumstances.

Loose Switches.—When Annie E. Hovey, a Scarborough boarding house manageress, was summoned, last week, at the local Court for a lighting offence, she offered the defence that the vibration of the door had caused the electric switches to drop and put on the lights in unoccupied rooms. The police constable said he thought that this was quite likely, as the switches were very loose. He said the bulbs had now been taken off the light fittings. The lady was fined 5s.

INDUSTRIAL CONDITIONS OF TO-DAY.

By "OUTSIDER."

We notice in one of the week-end papers the formation of a new alliance between employers and employed. The objects in view are stated as follows :—

1. The securing of a living wage.
2. The regulation of the hours of labour.
3. Women to have equal pay with men if work, skill, and output are equal.
4 (and following). The improvement of working conditions and the increase in output.

During the past few weeks the columns of the Review have shown a renewal of the symptoms of unrest which prevail in the power-station side of the electrical world. This trouble has been stirring for years, and to an outsider the conditions imposed by the war would seem to have aggravated it. A quantity of ink is used nowadays in dealing with labour questions in arranging promising schemes for the *rapprochement* of masters and men. The majority of these plans are unfortunately, however, merely in the nature of pious hopes, which it is to be feared will never cut much ice. Strikes and rumours of strikes appear in the Press, and letters of complaint in the technical journals, *re* the poor prospects of this or that branch of the industry, and in conversation with the man in the street, one hears threats of trouble to come after the war. The aims of the new alliance above set out would seem to provide adequately for the worker, whereas the employer only just sneaks in at the finish for an increased output. However, a little ventilation of these points will do no harm, and may even save some disappointment. Without confining attention exclusively to the power-station workers, or any one branch, a few notes may be made as to the existing industrial conditions.

Taking the items as they stand, the wage question is, as a matter of course, first. It is not easy to-day to define a living wage. Wages expand and prices soar in regular alternation. There are those who hold the opinion that wages and prices are engaged in an insane competition, the result of which is not at present clear. Apparently the worker who secures a living wage is the one whose Union is powerful enough to enforce its demands for an increment step by step with the increase in the prices of life's necessaries. The others take their chance among the "also rans." The farm labourer gets 30s. per week, the unskilled factory hand and the semi-skilled a little more or less, according to their job and locality. Skilled people draw all sorts of rates, from three guineas standard upwards, and in places like Sheffield men and boys are paid unheard of wages. The clerical worker contents himself with a war bonus, the amount of which depends sometimes upon a new constant—the extent to which his employer's profits are liable to excess profit tax. We do not cavil at this, but merely mention it by the way. There were, we remember, firms who reduced their salary bill at the outbreak of the war in order to economise ; we wonder if those salaries are still limited and reduced. Apparently power station attendants are not sharing in the big rises. The pay of another State servant—the ordinary Tommy—is grossly unjust, and especially so in the case of one who has risen from the ranks and is without private means. Some workers, therefore, are overpaid and some the opposite. It might not be impossible for one of our enormous new Departments to take the wages question in hand, and to standardise things a little ; this would ensure more equality of treatment than prevails at present. We are all controlled, and the State is the one tribunal which possesses the necessary authority to set the matter upon a proper basis, at least for the duration of the war. Few will quarrel with our opinion, we imagine, that the large prices are more due to high wages than the reverse.

The second point, hours of labour, is regulated to-day solely by the grim necessity which war imposes and the shortage of labour intensifies. Most people have to work very long hours, and the consideration of the working day is, therefore, more in the nature of an after-war proposition. The claim for equal pay for the same work as between men

and women is interesting and opportune. Whether our experience is representative or not, it goes to show that as yet women's pay is less than men's pay by at least 25 per cent. Further, signs are not wanting that the intention of employers is to substitute women for men permanently. We have no desire to lay down the law to employers, who are free to train women as they may. At the same time, most of the men so replaced are in the trenches to-day, and as many of them as do return will want work. This points to a reduction in wages some day as a direct result of female competition. The new alliance will score heavily on the side of the men when it secures equality of pay by increasing the woman's wage, yet care may be necessary, or the process will be *vice versâ*.

The several remaining points on the list refer to conditions of work and increased output. Output, judged by prevailing standards, would seem to call for no special worry. The war has done more for it than all the Blue-books, technical schools, institute proceedings, and political parties have accomplished in two or three decades. Output is soaring, but conditions of work are bad. Workers jeopardise their fellows' lives by criminal carelessness; strikers still down tools and barter for more money. Thousands of married women workers whose job ends with the war are subject to a weekly deduction on account of unemployment insurance, for which they will get little or no return, because they will not claim it. Employers still advertise for "junior" assistants in large power stations at small wages, when there are no juniors about, save returned disabled soldiers. Men must do this job or that, or go into the Army. Others, with Tribunal influence, are excused service on condition that a munition works receives them. These latter are often of little use, yet others who have been years in the same works have to go, willy-nilly, into the ranks. The presence of an Irish labourer on a farm has sent many a married Englishman into the Army. These are all, as our American Allies say, "some" conditions. The Minister of Labour proposes to establish we know not how many new labour exchanges. More to the purpose would be a systematic visit to our labour centres, in and out of some of the 5,000 controlled works; there he might find food for serious thought. All the eminent speakers skate round the subject most carefully, and exhale pious platitudes. The workers are heart and soul in the war; the pacifist occupies a lonely furrow, but profits and prices are so distended that unrest in some quarters is inevitable. The man in the street is sated with the written homilies which have rained on him lately as to what he must or must not do, while he sees others making their own commandments. It will be taken as a sign of the *bonâ fide* intentions of the people who talk so much of conditions after the war, if and when a small instalment of reform is instituted in the near future while the war is on.

NOTES FROM CANADA.

(From our Special Correspondent.)

On October 24th, in a small town of some 25,000 inhabitants, named Brantford, in Ontario, a monument was unveiled to commemorate the invention of the telephone by Dr. Alexander Graham Bell. The inventor himself was present, and related how, in the summer of 1874, his discovery was made, in Brantford; apparently owing to much experimental work having been carried out in Boston in those early days, some people have been under the impression that the telephone was actually invented there, but Dr. Bell stated that he was "glad to be able to come home and say that the telephone was invented here" (in Brantford).

The Duke of Devonshire, Governor-General of Canada, unveiled the monument, which is described by a daily paper as follows:—

> The memorial stands upon an elevation in a small square in the heart of the city. In the centre, in a marble setting, is a great bronze bas-relief symbolising the transmission of sound through space, while mounted upon columns on either side are bronze figures representing humanity in touch. The conception of Walter Allward, the sculptor, is strikingly original, and its execution a remarkable piece of work.

According to *Conservation*, a small monthly bulletin published by the Commission of Conservation, a new Order in Council has recently been passed by the Dominion Government to preserve to the public the ownership of water powers on Dominion lands. This Order provides that, whenever any Dominion lands are disposed of in future, that portion of them necessary for the protection of a water supply or bordering on, or close to a water power, and necessary for its development, will be conveyed only on a year-to-year lease. A provision to this effect is to be inserted in all letters patent. Apparently the Commission of Conservation takes some credit to itself for the passing of this Order.

The demand on Canada's great water powers for the supply of electrical energy is growing very rapidly, in the Provinces of Ontario and Quebec particularly, the war undoubtedly being chiefly responsible.

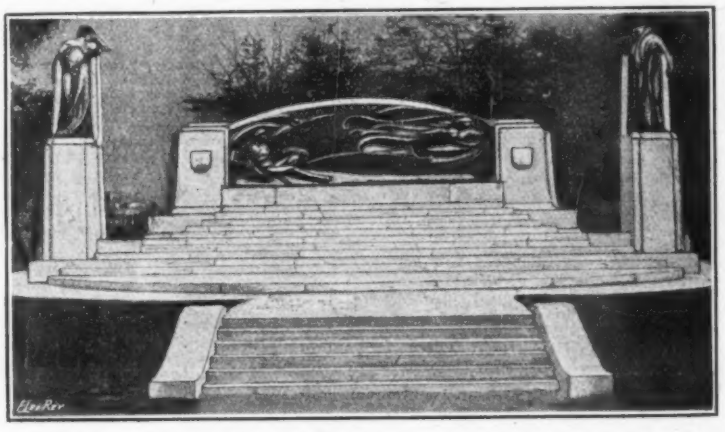
In Quebec, the Shawinigan Water & Power Co. expects before the end of this year to have 18,000 H.P. additional business. Various large companies taking big blocks of power have very greatly increased their demands; the Carbide Co. alone is said to be taking 40,000 H.P.

A transmission span 5,000 ft. long, with 350-ft. towers, is being erected over the St. Lawrence at Three Rivers. The Southern Canada Power Co. is planning extensions on a very big scale, and various others are proceeding on similar lines. The particular company named intends erecting 88 miles of high-tension transmission lines connecting up a number of cities.

The *Electrical News of Canada* for October 15th last contains an article by Mr. B. L. Steele, Professor of Physics, State College, Washington, in which the efficiencies of various types of cooking ranges are given. The following are interesting:—

Flame contact burners (kerosene, gas, &c.)	20 p.c. to 35 p.c.
Electric heaters, surface	45 p.c. to 65 p.c.
Electric heaters, enclosed	70 p.c.
Electric heaters, immersion	90 p.c.

Very great care appears to have been taken to account for all factors which would affect the relative results.



The Telephone Memorial at Brantford, Ont.

In British Columbia there are reports that various companies will spend considerable sums of money on power development. The Kootenay Power Co. intends building a high-tension line to cost about 2½ million dollars, and the Canada Copper Co. will spend a similar amount on work at Copper Mountain.

The power situation in the Province of Ontario is becoming very awkward, due to the immense demand for electric power for munitions purposes. No doubt this demand has been augmented, apart from other causes, by the high price of coal (bituminous coal costs from two and a half to three times as much as before the war), and by last year's actual shortage, when it was almost unobtainable; but this does not alter the fact that the Hydro-Electric Power Commission will this winter be hard put to it to find enough power to go round. Already the Toronto Hydro-Electric Commissioners are advertising in the daily papers requesting people to use as little current as possible, even in their homes, between the hours of 4.30 and 6 in the afternoon.

Sir Adam Beck, the Chairman of the Provincial Commission, is urging the Dominion Government to stop, or largely reduce, the export of electrical energy at Niagara Falls, so as to leave as much as possible available for Canada's own needs, enabling the munitions factories to continue their opera-

tions unhampered by lack of power. Rather naturally, the United States' firms who have been purchasing this power for years, and whose power requirements for war purposes have been increasing very much in the same way as those of Canadian firms, protest against the power being taken from them. What the Dominion Government will do in the matter remains to be seen; at present it is probably a somewhat delicate international question, for both sides appear to be in a position to argue that the power is required for war work.

Another question which is before the Government just now is the application made by a private corporation to build a dam across the St. Lawrence river at Cornwall, Ont., with a view to hydro-electric development. The Commission of Conservation, which has already done much good work in looking after the rights of the Canadian public in respect of water powers, has taken the matter up, and is strongly supported by the Hydro-Electric Power Commission of Ontario.

It may not be generally realised in England that this Commission, in addition to having actually developed two water powers of small size at Wasdell's and Eugenia Falls respectively, and to supplying power from several other moderate-sized plants in the Province which have been taken over, recently took over the entire plant equipment and property of the Ontario Power Co. at Niagara Falls; the Commission is now operating this large station for itself.

The great Chippewa development scheme is also in hand now, preliminary work having been started some little time ago. This scheme involves the building of a canal from Chippewa (above Niagara Falls) to a point near Queenston, some 13 miles in length. By this means, besides getting all the head of water available at the Falls, amounting to about 165 ft., a further 130 ft. or so, due to the difference in level between the foot of the Falls and Queenston, is made available, thus almost doubling the power obtained for each unit quantity of water.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Prohibited Imports.

May we appeal through your columns to all lovers of fair play for assistance and advice?

Your readers know that we have introduced into this country thousands of public-utility devices essential for economy, and of a design not manufactured in this country, but urgently needed at the present time. In spite of the importance of these goods, a total prohibition has been placed on their importation. "Hotpoint" heating and cooking apparatus has not only done, and is doing, good service here, but it is in the unique position of being guaranteed for long periods.

This prohibition is not only on new goods, but on spare parts necessary to enable us to carry out our obligations. Thus, not only is a new business being unnecessarily destroyed, but our good name for straight dealing is jeopardised by this refusal to grant us permission for repair parts to the extent of *even one cubic foot per month*.

How is it that at least two English concerns are still able to *continuously* advertise *American* electric vacuum cleaners? These were prohibited in June, 1916; we, the actual *American makers*, have had none since! Again, import licences have been granted to approved flash-lamp importers for between 25 per cent. and 50 per cent. of their 1916 imports—this, we agree, is valuable merchandise; an unknown proportion go into useful and important service, while an equally unknown proportion are idle toys. Could not some of the tonnage thus wasted be utilised for important coal and labour-saving goods which are not, and never have been, manufactured in sufficient quantities in this country?

Why not have a fair arrangement? Either definitely prohibit all such goods if competent, *unbiased* authorities advise such a course, and make no exceptions and favour none, or else grant permits for 10 per cent., 20 per cent., or some percentage of previous trading, so that we can all at least exist, and retain our good name, for which we have worked, and of which we are proud.

Hotpoint Electric Heating Co.
L. G. Hawkins, *Manager*.

London, W., *December 4th*, 1917.

P.S.—Expressions of opinion, assistance, and advice from central-station engineers and dealers would be appreciated.

The E.T.U. or the A.E.S.E.?

I have noted for some weeks past that a controversy is proceeding in your columns between the E.T.U. and the A.E.S.E. While some good points have been discussed, the vital point has always been side-stepped, viz., the actual status of the "charge," or "shift" engineer. It must always be remembered that while an engineer does not wish to be deemed snobbish, at the same time he has to preserve discipline amongst his men, and it cannot be denied that should an engineer join the same society as his men, there are some who would be quite ready to take advantage of it, and so spoil all the good that would otherwise accrue. At the same time, an engineer cannot afford to ignore the men altogether, for it is quite possible for those men to run the job without him, should his society decide to take "industrial action," or whatever other form of attack they decide upon. The only course open to him is to join a society that has a working agreement with that of the men. In my way of thinking, "industrial action" is to a great extent unnecessary, as has been proved since the outbreak of war by the settlement of cases by arbitration, which, though not what we may call absolutely satisfactory, has at least been accomplished without the privations and inconvenience of strikes. Before closing, I should like to endorse Mr. Vincent's letter, in which he practically advocates the fusion of all unions catering for the electrical trade. At present I only know of one union that caters for *all* grades, and that is the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen and Electrical Workers, who represent practically all the generating stations in London.

W. H. Streeter.

London, N.W., *December 10th*, 1917.

Diesel Engine Fuel.

"Pulveriser's" article, "Diesel Engines and the War," is very timely, and ventilates a real grievance of Diesel engine users.

"Pulveriser" suggests that the present situation in regard to the use of Diesel engines has arisen out of the system whereby each Government Department works in its own water-tight compartment, and is quite oblivious to what is happening beyond its own limited horizon. The facts appear to confirm "Pulveriser's" view. How else are we to reconcile the Creosote Controller's order, dated October 23rd, 1917, limiting the use of tar oil for Diesel engines, with the unofficial hint dropped from an official source about 12 months ago to "adjust your Diesel engines to burn tar oil"? Or the Ministry agreeing, less than six months ago, to munitions concerns extending their existing Diesel engine plant with further Diesel engines?

If the Navy *must* have all the tar oil in the country, then is it not the Government's duty to ensure a supply of suitable petroleum oil, at reasonable prices, for the Diesel engines already installed? Perhaps they cannot altogether control foreign oil companies, or insist upon English oil companies importing the fuel into the country, but they can at least fix a reasonable figure upon insurance rates for ship and cargo.

A number of contracts made between a large English oil company and sundry Diesel engine users, the contracts dating from 1916, may now have to be modified or cancelled. That, at least, is the oil company's suggestion. They have asked their customers under contract with them to accede to an increase of £5 a ton over and above the contract price "to cover part of the Government insurance rate on ship and cargo." They go on to state that when the contract was entered into insurance rates were a few shillings a ton, whereas now they are 208s. a ton. The oil company have made a bad bargain, and, from the ethical point of view, it is to be regretted that they should write to their customers suggesting modifying or cancelling the contract. But from the commercial point of view, Diesel engine users require to be assured of future supplies, and it is, therefore, desirable that the oil company should not be too hardly hit. The right and graceful thing for the Government to do is to revise the basis of insurance rates, fixing them at the price ruling at about the time when the above-mentioned contracts were made. The method of achieving this is suggested by "Pulveriser," namely, for the various Departments concerned to have a conference on the matter. To settle the fuel-oil problem for Diesel engines, representatives of the following Departments should confer:—

1. Admiralty (Fuel Oil Control).
2. War Office (Recruitment Department and Contracts).
3. Coal.
4. Food.
5. Shipping.
6. Railway Transit.
7. Creosote.

A decision arrived at in this manner would be accepted as fair at least by the majority of Diesel engine users, who would then know that their complaints had received due attention.

Flameplate.

Electricity and Agriculture.

It may be taken as agreed that there is to be a great development in the service that electricity is to yield to agriculture, the only wonder being that so little has been done already.

One of the chief reasons would appear to be the complete lack of intercourse between the two professions, and as a practical suggestion for getting over this difficulty I would propose that the Institution of Electrical Engineers should,

together with the representative societies of agriculture and horticulture, appoint a joint committee whose duty it would be to investigate the problems, and put them in the way of being solved.

It should be the duty of such a committee to arrange inter-society meetings for the reading and discussion of suitable papers, thus bringing into closer intercourse the two interests concerned.

The idea need not be confined to agriculture; as it is, our learned societies work too much in "water-tight compartments," and a closer collaboration would tend to produce greater efficiency all round.

E. S. S.

[Our correspondent is evidently unaware of the existence of the I.M.E.A. Committee on the Development of Electricity in Agricultural Areas, and, in common with others in a similar position, seems to call for more energetic propaganda by the Committee. It may be noted, too, that the Agricultural Committee of the Conjoint Board of Scientific Societies, which is also investigating this matter, is representative of both agriculture and engineering.—Eds. Elec. Rev.]

HEAT ENGINES.

In the Thomas Hawksley Lecture at the Institution of Mechanical Engineers, on November 30th, Capt. H. Riall Sankey, C.B., R.E., outlined the history of various forms of prime movers. He said that the prevailing commercial custom with the steam engine was to state the number of pounds of steam per I.H.P. or B.H.P. or KW.-hour, but this led to serious error in the case of engines running with superheated steam, and was contrary to the recommendation of the Committee on Engine and Boiler Trials of the Institution of Civil Engineers in 1897, which adopted the theory of equivalent feed, expressed as follows:—

Equivalent feed = actual feed × heat required per lb. of steam/1,100.

With low degrees of superheat the error was not very great, but with high degrees of superheat the error was considerable. For example, in a test on a battery of steam turbines of 200 B.H.P. running at 3,000 R.P.M., steam pressure 195 lb., superheat 200° F., and vacuum 28·7 in., the steam consumption given in the ordinary way was 8·5 lb. per B.H.P., but, according to the equivalent feed formula, it was 9·6 lb., an error of 11·5 per cent. In a second case there was an error of 28 per cent. Therefore, the heat economy of steam engines should be quoted in terms of equivalent feed, or preferably, in the number of B.TH.U. required to produce one B.H.P.-hour.

Reciprocating engines were gradually being replaced by the steam turbine for electric power station work, and to-day the slow-speed reciprocating engine was practically defunct for this purpose.

It was unfortunate that the suggestion by Thwaite, in 1895, to use blast-furnace gas led many engineers to the conclusion that large gas engines generally were practical. They did not recognise the difference between blast-furnace gas and producer gas. The result was that many firms took up the manufacture of gas engines, but had to drop out, so far as the majority were concerned, after losing much money.

The figures of heat economy for steam, gas, and oil engines had shown little improvement of late years. The practical limit had been reached, and there was little, if any, further improvement to be looked for. The best results now obtainable were:—

	B.TH.U. PER H.P.-HOUR.
Steam turbines	14,000
Gas engines...	10,600
Diesel engines	7,700

Both gas and oil engines had reached their limit as to size, but the steam turbine could be built in much larger units than had yet been attempted. Therefore, notwithstanding the considerably higher heat economy of gas and oil engines compared with the steam turbine, the latter would hold the field for large units, both for land and marine service, the reason being that it was a true rotary engine, and it would occupy this position until a satisfactory gas turbine was evolved. A few small experimental gas turbines had been built; so far, however, there had been no real progress, the main difficulty being to obtain material for the blading which would withstand the very high temperature of the impinging gas. There was also to be considered the loss due to compression of the combustible mixture of gas and air, which loss greatly reduced the intrinsically higher thermal efficiency of the internal combustion engine, so that under the best conditions it was not likely that the practical economy of the gas turbine would be more than a few per cent. better than that of the present gas engine. An experimental gas turbine must be of a very large size, and private enterprise would not be justified in incurring the great capital expenditure which would be necessary. The real object was to utilise the world's fuel supplies—coal, oil, and peat—to the best all-round advantage, and to that end increasing attention was being paid to devising means whereby fuel should not be burned to obtain heat until the so-called by-products had been separated. The recovery of by-products would only be economical in very large plants, and the same might be said of the generation of electricity in this way. Consequently, it might be expected that in the future coal and peat would be gasified in producers of such a character as to recover the maximum amount of by-products, and that the remaining gas would be used for generating electric power. Generally the monetary value of the by-products was greater than that of the heat-producing element of the fuel; hence, when they had been separated, it might be said that the cost of the fuel would be negligible. In fact, it would be the gas which was the by-product. From this it followed that the small percentage of economical gain in the gas turbine would be largely reduced in value. There was, therefore, justification for the conclusion that the gas resulting after the separation of the by-products would be used under boilers for generating steam for driving large turbo-generators.

WATER SUPPLIES AS SOURCES OF POWER.

By CECIL H. ROBERTS, M.Inst.C.E.

(*Abstract of paper read before the* Institution of Water Engineers.)

Many waterworks are in a position to generate power from the water before it reaches the service reservoirs, and in some cases, especially in districts far from coal supplies, water power could be generated and supplied at a reasonable cost. Some watersheds are capable of supplying as much as 100 million gallons of water per day from a considerable elevation, and the difference in level between the impounding reservoirs and the service reservoirs varies in different waterworks up to and over 500 ft.

Assuming that the surplus power available between the impounding reservoir and the beginning of the aqueduct amounts to 500 H.P., this could be utilised to operate turbines driving dynamos, and the electric power so generated would be sufficient to provide all the light and power required by a town of considerable size; the revenue obtainable, with very reasonable charges, would be in the neighbourhood of £15,000 per annum, sufficient to warrant a substantial outlay of capital on the necessary works.

A further advantage of combining power plant with upland waterworks lies in the fact that, as storage works on a large scale are often an essential part of a waterworks, a small proportion only of the cost of such works would be chargeable against the power scheme, and the outlay on pressure pipes, which would probably be comparatively short, ought not to be heavy.

A proposal to use for lighting and power purposes the power (about 400 H.P.) available at the Longdendale works of the Manchester Corporation was reported on by Sir Alexander Kennedy as long ago as 1899; although nothing was done at that time, hydro-electric works have since been constructed for utilising some of the power locally by Mr. Holme Lewis, the present water engineer of Manchester. Dr. Deacon, in 1902, described how a portion of the surplus power in the aqueduct of the Vyrnwy Works was utilised at Oswestry to operate "Brotherton" engines. More recently in the Birmingham Waterworks water turbines and dynamos have been installed for using a portion of the power available in the compensation water.

When the difference between the level of the impounding reservoir and that of the town to be supplied is considerable, it may be at times possible, without prohibitive additional cost, to construct the power house at a distance from the impounding reservoir and at a lower level, in order to secure a greater pressure at the turbines and utilise a larger proportion of the potential power. Although such a case might be complicated by compensation questions it would afford some advantages, such as the possibility of taking additional water from neighbouring watersheds, and thereby increasing the capacity of the power plant, and the reduction of cost of the machinery due to the greater head of water. The cost of generating power (the load factor remaining the same) varies inversely with the power and the pressure of water.

In some districts small towns or villages in the neighbourhood of the works could be supplied with electricity in bulk for lighting and power purposes; in other districts, light railways, saw mills, wood pulping, mines, quarries, chemical and other works might be supplied on mutually advantageous terms, and in the future agriculture should also provide a market for electric power; in fact, there should be few districts in which a market could not be obtained or created.

Opposition might be raised in Parliament to the combination of works for the joint supply of water and power, but in view of the national value of cheap power for industrial purposes and the necessity of conserving coal supplies as much as possible, such opposition might not be great.

In the discussion which ensued, Mr. A. J. E. Binnie said that, acting on the instructions of the Ministry of Munitions, his firm last August looked into the question of water-power possibilities. He had come to the conclusion that in this country they had between 200,000 and 300,000 H.P., which could be developed at prices starting at £2 10s. up to about £6 10s. per H.P.-year.

The general trend of the discussion went to show that it was only in the West Highlands that there was anything like sufficient water power available to make the generation of electricity possible on a paying scale in the British Isles, owing to the want of altitude of our water-bearing hills.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Halo" Reflector.

The "Halo" Co., of 7, Exchange Buildings, 6, St. Mary's Gate, Manchester, have placed on the market an easily fitted reflector ring for incandescent lamps, which is employed in the manner shown in fig. 1. The reflector ring is of glass, English-silvered, and provided with three adjustable copper clips to enable it to be fitted to the lamp bulb; it increases the downward light to a

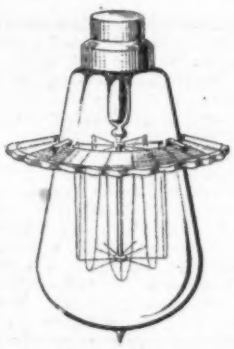


Fig. 1.—"Halo" Reflector in Place.

marked degree, as, indeed, is shown by a National Physical Laboratory test in which it was found that with the reflector there was 24·6 c.p. under the axis as compared with 4 c.p. without it—a 200-volt, 40-watt, ordinary metal filament lamp being used.

The reflector is slipped over the bulb before inserting the latter in the holder, and is shown in the view level with the base of the lamp filament.

A Simple Lock Washer.

In a letter to *Power*, Mr. P. H. Grigsby, of Glouster, Ohio, describes a lock washer which he has used for several years, and which is effective, simple, and easily made. In the illustration A is a slot in the washer, and B is a small hole at the same radius as C, which is a small cone-shaped projection. When used on metal, he says, "place the washer in position and with a centre punch

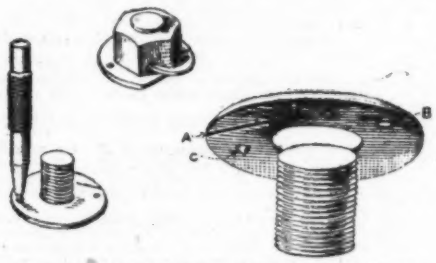


Fig. 2.—Lock Washer for Wood or Iron.

make a depression through hole B, rotate the washer until projection C fits into the centre-punch mark, screw down the nut, and turn up the edge of the washer at slot A, alongside of the nut. When used on wood, no punch mark is necessary. This washer can be cheaply made by a single operation of a punch press."

LEGAL.

Tramcar Collision Claim.

In Dumbarton Sheriff Court, the Anglo-Swedish Electric Welding Co., Ltd., Glasgow, claimed £302 from the Dumbarton Burgh and County Tramways Co., Ltd. The action was a sequel to a collision between a motor-lorry and a tramcar. The Sheriff decided that the collision was directly due to the fault of the driver of the tramway-car, and found the defenders liable to the pursuers in damages, which he assessed at £266, with expenses.

Soldiers' Tramway Fares.

At the West Riding Court, last week, the Magistrates heard a test case as to travelling facilities for a soldier. The Yorkshire (West Riding) Electric Tramway Co. summoned Corporal Robert Brown, of the Royal Defence Corps, a guard at a neighbouring internment camp, for travelling on a car and refusing to pay full fare. Up to a few weeks ago soldiers had been allowed to travel at half-fare, but the privilege was withdrawn, and now artisans, mechanics, or daily labourers were the only people allowed to travel at half-fare. Defendant claimed to be a daily labourer as much as any other workman, and said soldiers took it as an insult that they should be excepted because they wore the King's uniform. The case was adjourned for a week for consideration.

Gas Light and Coke Co. v. Hackney Borough Council.

(*Continued from page 537.*)

On December 6th, Mr. A. J. Walter, K.C., continued his address on behalf of the respondents, the Metropolitan Borough of Hackney, in support of the judgment of Mr. Justice Astbury. He said that in the Long Eaton case a power user who took light made his load factor worse, and yet was charged less per unit, though the station was worse off by his taking light, as its plant was used fewer hours each quarter. In Hackney a light user who, for each unit he used for light, had under the scale to use 4 units for power, greatly benefited the station by using the plant for more hours each quarter, and was rightly charged less per unit for his total supply than was charged to a mere light user with his worse load factor. No case had been suggested of unfair discrimination between power users; and, in fact:—

1. On the scale complained of, every power user had the same right of using 20 per cent. of the total supply for lighting.

2. The scale complained of was only available for factories and workshops. If a man used power alone he paid less per unit on his maximum demand scale than the man who used power and light, owing to the automatic working of the load factor.

Mr. Colefax then replied on behalf of the appellants.

On December 7th, Mr. Colefax concluded his arguments, and their Lordships reserved judgment.

Holt v. A.E.G. Electric Co., Ltd.

In this case, to which brief reference was made last week, a settlement was arrived at in the Chancery Division on December 5th, before Mr. Justice Younger.

Mr. Holt claimed salary under an agreement, notwithstanding that he had been called to the Army. The company, which is wound up under an Order of the Board of Trade, under the Trading with the Enemy Act, by its Controller, admitted that this was a case in which a payment might be made, but raised the objection that under Sec. 1, Sub-Sec. 7, of the Act, this action could not be brought without the consent of the Board of Trade.

His Lordship directed that the sum agreed upon in Chambers should be paid to the plaintiff in full settlement of his claim, holding that the section relied upon did not preclude the plaintiff from bringing his action without the consent of the Board of Trade.

WAR ITEMS.

Exports to China.—The "London Gazette" for December 11th contains further names of persons and bodies in China to whom exports may be consigned.

Shipbuilding.—The Minister of National Service has issued a special appeal for suitable men employed in non-essential undertakings to take up unskilled work in shipyards. It is considered that men who are doing work that women could do should volunteer, but they must possess the necessary physical strength for work in shipyards.

Trading with the Enemy.—The "London Gazette" for December 7th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Chile, Denmark, Greece, Hayti and Dominican Republics, Netherlands, Netherlands East Indies, Norway, Peru, and Spain.

Tungsten Ores.—In the "London Gazette" for December 7th there is printed in full the new Order of the Ministry of Munitions applying Regulation 50A to tungsten ores, molybdenite and metal, and products therefrom, and requiring returns.

Trade Policy.—Last week we quoted a reference by the *Daily Chronicle* to the recommendations of Lord Balfour of Burleigh's Committee on trade after the war. The *Daily Telegraph* understands that there are three documents—a majority report and two minority reports. "One of the minority reports, signed by Lord Faringdon and others, advocates the imposition of an *ad valorem* tariff of 10 per cent. on imported manufactured and semi-manufactured goods, lower duties to be imposed by arrangement with foreign countries. There is a Free Trade minority report, which is against a general tariff. The majority report, which is supported by some of the Free Trade members of the Committee, takes a middle course. It advocates a tariff on imported manufactured and semi-manufactured goods, the maximum to be below 10 per cent. It is believed that the three reports concur in recommending that special steps be taken to preserve key industries, such as aniline dyes and optical glasses. Other industries important to the national well-being, which have been restarted during the war, ought to be preserved from the effects of foreign competition until thoroughly established."

Exemption Applications.—At the request of the National Service Representative, Fulham Tribunal reviewed the certificate of conditional exemption granted to an electrician, 39, married, passed for general service. The respondent said he was engaged in installing electrical plant at a glycerine works on behalf of a Queen Victoria Street firm. Official documents were produced showing that if the certificate was cancelled his retention would be claimed by the Ministry of Munitions. In reply to the Chairman, the man said he worked 11 hours a day seven days a week. The Tribunal decided to make no variation.

The Manbre Saccharine Co., Ltd., opposed an application to the Fulham Tribunal to vary the certificate of conditional exemption granted to an electrician in their employ, aged 39, married, who was granted conditional exemption a year ago. He had charge of the electric lighting and power plant, and was responsible for all fittings and telephones. He had been with the firm for 12 years, and had only one assistant. The machinery was running continuously, and the man frequently had to work all night in addition to his regular work seven days a week. No variation was made.

At Newhaven, temporary exemption was sought by E. Hilton (18), assistant engineer at the Rottingdean electricity works. The engineer (Mr. J. W. Brown) said that there were only himself and Hilton left at the works, and he would be content if the Tribunal allowed exemption until daylight-saving came in force next year, as then he would be able to manage without him. The Tribunal refused the appeal, but Captain Boyne undertook that Hilton should not be called up until March 25th, the Chairman saying that that meant that he would not have to join the Army until 10 days after that date.

An electrician in business in Saltergate appealed to the Chesterfield Tribunal for exemption for an assistant (18, grade 2), but the appeal was rejected.

At Weymouth, Messrs. Brooking & Co., electrical engineers, appealed for H. J. Barrow (34, Class A), wireman. His certificate of conditional exemption has been withdrawn, and he was given temporary exemption until Feb. 28th.

The East Sussex Appeal Court heard an application for extended exemption made by an electrical engineer at Burgess Hill (41, B 1). He said that he had sole control of a generating stating supplying, among other things, power and light to munition factories, and that he had been urged to undertake further supplies for munition works. Major W. W. Grantham (National Service Representative) submitted that, having regard to the time already given to appellant, arrangements should now be made. The Court allowed three months' open exemption.

At Reigate, an appeal was made for exemption for C. W. Read (36), shift engineer at the Corporation electricity works, on the ground that he was indispensable and in a certified occupation. He was given conditional exemption.

At Windsor, Mr. N. L. Jackson, Stoke Park, applied for exemption for V. H. Froud (37), electrician, and six months' temporary exemption was allowed.

At Chatham, Messrs. Barnard appealed for exemption for H. W. Whittaker (18, grade 3), electrician at the Theatre Royal. Exemption was refused, with 28 days' grace.

BUSINESS NOTES.

Christmas, 1917.—We shall be glad if readers, contributors, and advertisers will note that the greater part of our issue of December 28th will have to go to press some days earlier than usual, owing to the Christmas Holidays. A notice by our advertisement department appears elsewhere in the present issue. We shall be glad if advertisers and contributors will forward their "copy" and manuscript much earlier than usual. New advertisement copy and alterations to existing insertions should be received by Friday morning, December 21st.

New Co-operative Scheme to Develop British Export Trade.—Mr. G. C. Mandleberg, chairman and a managing director of Messrs. J. Mandleberg & Co., Ltd., Pendleton, Manchester, has placed before British manufacturers and producers the outline of a scheme on national lines for the direct encouragement and development of the British export trade.

The main proposal is to organise British manufacturers and producers into a body for the specific purpose of securing more orders from overseas. Mr. Mandleberg suggests the formation of a corporation to develop trade in old, and more especially in new, markets, for the mutual benefit of members. The method proposed is to make available for all firms in the new British Manufacturers' Corporation, which is the title suggested, the means which business experience shows to be the most effective in developing foreign trade. This is the employment of representatives abroad, men of first-class ability, and possessing thorough knowledge of the business conditions in the different foreign countries to which they will be appointed, and where they shall be resident. They will be known, it is suggested, as agents-in-charge. They will find and appoint the right men as local selling agents for individual firms, get first news of fresh trade openings, report on the standing of possible customers, and generally superintend the business interests of all firms in the organisation. The result, it is suggested, would be to give every firm in the organisation the advantages of a branch in many parts of the world without the expense of establishing and maintaining it. Mr. Mandleberg contemplates an organisation of a 1,000 members subscribing £100, or £200 each per annum. With a fund of £100,000, or £200,000 per annum, he suggests, very strong inducements could be offered to likely men to be agents-in-charge. The latter would have adequate staffs of experts to assist them, and a code system could be devised to facilitate prompt communication. Mr. Mandleberg points out that no existing organisation covers this ground, while the scheme would be complementary to the new Government proposals for helping overseas trade. We are informed that the scheme is being widely discussed in Lancashire, and is being actively supported by manufacturers there. It is intended that steps shall shortly be taken to form a provisional Committee, and formulate the scheme in detail.

To electrical manufacturers and traders the argument that only by increased output, as compared to pre-war production, shall we be able to carry the inevitable increased taxation, and maintain increased wages to meet the extra cost of living after the war, is already very familiar. If we are at the same time to quote competitive prices, the cost of production must be reduced by the adoption of the most modern improvements.

The demand for this increased output is to be looked for partly by a larger demand from the home market, and largely by a big expansion of the export trade. As we have urged for many years past, we shall have to find new markets and to intensively encourage the existing ones. For many firms in the electrical trade, especially the smaller ones, this will best be effected by co-operative action either in production or in salesmanship or in both. The electrical industry knows this well enough, and efforts are being made in a number of directions. Probably they would have been far more widely adopted and more energetically pursued had not the uncertainties and prepossessions of war-time imposed a handicap. It has long been recognised that our industry will be most efficiently served by specialised representatives; everybody knows that in the past the general representative dealing in all things in common, with electrical manufactures sandwiched in somewhere or other, has not been a successful British electrical trade-getter. Whether under Mr. Mandleberg's scheme it will be possible to give our large department of specialised technical industry that peculiar representation that it unquestionably requires, will doubtless be answered by electrical manufacturers for themseves. As a general export trade organisation there is doubtless great scope for the proposed British Manufacturers' Corporation, and it may be that some of our smaller firms may find it good policy to investigate the scheme and give it their support. We therefore quote below the main functions which it is intended to perform :—

1. To superintend selling arrangements for every firm in the organisation.
2. To appoint selling agents for individual firms or combinations of firms where agents have not hitherto been appointed.
3. To report, where desired, on the standing of purchasers.
4. To carry out, if desired, any financial arrangements between producers and purchasers where transactions lie outside ordinary business routine.
5. To act in an advisory capacity to members if they need information as to the best methods of securing further trade.
6. To get early information of possible orders and communicate immediately with the local agents of manufacturers concerned. Where no local agents have been appointed, the information could be conveyed to the home manufacturers.
7. To act as legal representative of any firm in the corporation should any dispute over goods arise.
8. For the purpose of facilitating communication between manufacturers and their agents it would probably be desirable to open offices in the chief manufacturing centres here, with a small staff in each. A code system could then be devised as a medium of communication between the home centres and the agents-in-charge everywhere.

The corporation would have as its one and only object the encouragement of direct trade on the lines indicated. It would not be a corporation for the earning of dividends. The entire benefits would go to members. Control could be vested in a board of directors selected with particular reference to their knowledge of the export trade in the various countries.

Siam.—According to a recent official return, the imports of electrical goods and apparatus at the Port of Bangkok during the last fiscal year attained a value of £65,770, as compared with only £31,610 in 1915-16.

Electrical Machinery in British Malaya.—A section of the annual report of the Senior Warden of Mines in the Federated Malay States is devoted to the inspection of electrical plant in use in the country. From the last report, by Mr. W. Eyre Kenny, M.Inst.C.E., it appears that in the F.M.S. alone there were 80 installations of generating plant in 1916, of which 50 were in the State of Perak and 22 in Selangor. The employment was as follows, in KW. :—Mining, 7,918; agricultural, 200; general, 228; Government, 10. In KW. it was allocated as follows :—Power, 7,936; lighting, 2,865, giving a generating aggregate of 10,801 KW. Government plant was responsible for most of the lighting. The above figures refer only to generating plant driven by prime movers. There is, in addition, motor-generating plant in use of about 400-KW. capacity. The H.P. of motors employed aggregates about 10,250, the increase from the previous year's figure of 9,000 being due mainly to the inclusion in last year's return of auxiliary and converting plant in Kuala Lumpur electric light station. Mr. Eyre Kenny reports that the larger power plants, which are, perforce, controlled by first or second-grade electrical engineers, are, as a rule, kept in good condition; smaller mine-lighting plants, which are generally controlled by native chargemen, supervised by Europeans, who have little or no electrical knowledge, are not so satisfactory.

The statistics of the Imports and Exports Department of the Straits Settlements show that the United Kingdom supplies most

of the electrical machinery and accessories in use in British Malaya. For four years the total value of imports and exports was as follows :—

	Imports.	*Exports.*
1913	£73,978	£8,324
1914	50,898	13,046
1915	39,690	23,705
1916	44,203	21,336

The United Kingdom's share of the 1914 imports amounted to £39,408, Germany's to £4,310, and the United States' to £2,075. The statistics for 1913 are compared below with two war years :—

	1913.	1915.	1916.
United Kingdom	£58,415	£30,705	£33,450
Germany	9,474	221	—
Denmark	973	415	883
Japan	827	931	1,784
United States	787	1,538	2,310
Italy	649	884	1,640
Sweden	427	—	—
Austro-Hungary	160	—	—
Netherlands	134	1,994	580
Hong-Kong	—	—	1,198
China	—	—	702

The only figures calling for special mention in the above table are those of the Netherlands, which suggest that possibly German exports found a way out through Dutch ports. It is easy to understand how the United States and Japan have been able to expand their markets in the Far East during the present upheaval in Europe ; but the statistics for Hong-Kong and China are less easy to explain, unless it be that the enterprising engineering firms of Hong-Kong and Shanghai have carried their enterprise into new fields of manufacture. More likely this is a transit trade of which the original port of shipment is lost for statistical purposes. To anyone unacquainted with the trade of the Straits Settlements ports, the proportion of exports may appear high. As a matter of fact, only a small proportion of the exports leave the Malay Peninsula for Siam and the Dutch Indies, most of the goods being exported by rail to the hinterland provided by the Federated Malay States, which took £6,195 in 1913, £19,921 in 1915, and £13,871 in 1916. In the latter year, the un-Federated Malay States took electrical machinery and accessories valued at £3,470, and as the Malay Peninsula is being rapidly opened up by railway and road communication, there should be a growing demand for machinery of all sorts in this region after the war.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C. 4.—76-page illustrated catalogue of wiring installation accessories, covering their standard types of material in general use, such as lampholders, switches, wall plugs, ceiling roses, cut-outs, distribution boards, fuse boxes, wood blocks, insulators, &c. The list is conveniently arranged in five sections, each dealing with a particular type of accessories. The outer half of each page is given up to the illustrations, and the inner to descriptive and other details of the devices. No prices are included in the list, owing to the price fluctuations in this class of material under war conditions ; but the company issues regular monthly quotations on such material. Among the lines of particular interest in the list are :—New line of porcelain type Goliath-Edison screw lampholders designed to comply with the requirements of the Admiralty and other Government Departments ; new substantial designs of brass-cased Goliath holders ; standard bayonet and Edison screw holders, in both porcelain and brass case types ; the "Quiklok" cover ceiling rose, which can be wired on the bench and secured in position on the ceiling by a quarter turn of the wrist ; the B.T.H. interlocking switch plug ; also a line of new pattern distribution fuse boards and a new range of insulators.

Messrs. Alfred Herbert, Ltd., Coventry.—Illustrated postal card showing their First-Aid Cabinets for factories.

British Thomson-Houston Co., Ltd., Rugby.—Twenty-page descriptive list (No. 2,180), giving full details with illustrations, tabulated data, dimensions, and shipping particulars, respecting their vertical spindle induction motors.

Book Notices.—*The Inspection of Screw Gauges for Munitions of War.* By H. J. Bingham Powell, M.Inst.C.E.—We have received this pamphlet from the author, the Inspector in Charge, Department of Gauges and Standards, British Ministry of Munitions of War in the United States ; it was written to assist gauge makers and manufacturers of munitions of war in acquiring accurate gauges, by standardising their own methods of inspection. While this question is of vital importance, it is an exceedingly difficult one, and has occupied the attention of a number of experts of the highest standing for some years past, especially since the outbreak of war. The author describes various methods of accurately measuring the pitch of screws, including a machine devised by himself, and deals also with the measurement of the three diameters of the threads of plug and ring screw gauges. The pamphlet will prove of great interest and utility to all manufacturers whose work involves the production of screw gauges accurate within very narrow limits.

We have received a copy of the *Skyscraper*, the magazine of the London Electrical Engineers (R.E.T.), a production which should take high rank amongst the many publications of the same type which have been established during the war. The December issue is accompanied by a coloured card of Christmas greetings, appropriately illustrated with a display of searchlight beams and an anti-aircraft gun, designed by Sapper Broad ; with this issue the first year of publication is completed, and we note that the Editors, who, for obvious reasons, had hoped it would be the last, are now prepared to carry on for another year. The magazine is full of good stuff, including humorous anecdotes and sketches of life on active service ("by the sea"), short stories, an essay on "Charles Dickens and Music," chess problems and puzzles, &c. It is admirably produced, and reflects great credit on the literary and artistic abilities of the staff.

"Telegraph Practice." By J. Lee. London : Longmans, Green, and Co. Price 2s. 6d. net.

"Telephone Troubles." By W. H. Hyde. London : S. Rentell and Co. Price 7d. net.

Calendars for 1918.—Messrs. J. Hopkinson & Co., Ltd., of Britannia Works, Huddersfield, have sent us a useful wall calendar. The design consists of a large sectional view of one of the firm's valves with a block of daily date slips based thereon, while at the sides there is neatly inset in small type a complete calendar for the year.

Social.—A successful social evening, in aid of local war charities, was held by the employés at the Phœnix Dynamo Manufacturing Co., Ltd., Bradford, and their friends, last Saturday, at a new canteen on the works. Mr. Pybus, the managing director, presided.

Anglo-Italian Trade.—The British Italian Commercial Association (Inc.) has been registered to promote the extension and development of mutual trade and economic relations between the British Empire and Italy, to collect and circulate statistics and commercial information, &c. The first directors are Mr. R. Benson, Mr. J. W. B. Pease, Sir Francis Barker, Sir Chas. L. Ottley, Sir Algernon Firth, Sir Hy. Babington Smith, and Mr. G. P. Harben (Commissioner for Italy). Secretary, Mr. J. F. Rose, 5, Victoria Street, S.W. 1.

Prices Increased.—The Sterling Telephone and Electric Co., Ltd., announce that owing to the continued advance in wages and manufacturing costs generally, they have further increased their prices. All prices in their catalogue are plus 80 per cent. advance, with the exception of switchboards and accessories thereof and C.B. switchboards, which are plus 100 per cent. advance. The advance dates from Monday last.

Liquidations. — Morris & Witham, Ltd., 9, Southampton Street, Holborn, W.C.—Under a compulsory winding-up order made last October, accounts have been lodged showing gross liabilities £3,483, of which £2,159 is expected to rank against assets valued at £1,387. The deficiency to the contributories is estimated at £1,774. According to the Official Receiver's report, the company is interested in various inventions and applications for patents relating to metal-filament electric lamps, in conjunction with the late Mr. J. A. Allison ; sums amounting to £89 appear to have been expended thereon, but the company's interest is valued in the statement at £50. The failure of the company is attributed to the guarantee by it of payment of an engineering company's debts.

National Provincial Electricity Corporation, Ltd.—A meeting of creditors is called for December 20th, at Balfour House, Finsbury Pavement, E.C. 2. Mr. S. Gillatt, liquidator.

Kingston & Co., Ltd., Margate.—A statement of affairs issued by the liquidator (Mr. John W. Scarlett) shows a deficiency of £407. It was submitted to the meeting held last week.

Invicta Engineering Co., Ltd.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. F. C. Harper, 27, Chancery Lane, W.C., by December 27th.

Bankruptcy Proceedings.—Samuel Stephen Coster, electrical, &c., engineer, who had traded at 14, Gladstone Road, West Ham, under the style of S. S. Coster & Co.—The public examination was held last week, at the London Bankruptcy Court, before Mr. Registrar Hope. The accounts showed liabilities £670, and assets, "bad book debts, £490." Questioned by Mr. E. Leadham Hough, Senior Official Receiver, the debtor said he began business in August, 1908, with a capital of £150, in partnership with one Roscoe, at 144, Bishopsgate Street, E.C. The business was not a success, and was abandoned 10 months later, all the debts being paid in full. He subsequently started a similar business alone, but used the trading style of S. S. Coster & Co. The bankrupt was examined at considerable length regarding certain purchases made by him, and eventually Mr. Hough observed, "I suggest to you that you have been carrying on what was practically a long-firm fraud by misrepresenting your status in order to obtain credit." The bankrupt denied having done anything of the sort. He was ordered to furnish cash and goods accounts, and the sitting was adjourned till January 23rd.

Auction Sale.—By order of the liquidator, Mr. J. Holness will sell by auction, at Margate, on Thursday, December 18th, the electrical plant and stock-in-trade of Kingston & Co., Grotto Gardens (in voluntary liquidation). For particulars see our advertising pages to-day.

Trade Announcement.—Messrs. David Bone & Co., of Glasgow, announce that, owing to the new Government Act regarding the registration of business names, they have altered the firm name to David Bone & John McNicol, but the constitution of the firm is unaltered.

Argentine Republic.—The imports of electrical goods into the Argentine Republic during the six months ending with June last attained a value of only £298,000, as compared with £353,000 in the corresponding six months of 1916.

Italy.—A new company has lately been formed in Rome with a capital of £160,000 and the title La Società Italiana Carbon Elettrici.

LIGHTING AND POWER NOTES.

Atherton.—The electrical engineer reports that there is a growing demand for electrical fires in the district, and a number of these have already been connected to the supply.

Ballymoney.—The Council has requested Mr. J. McClenaghan, of the Portstewart Electric Supply Co. and the Ballymoney Gas Co., to submit a scheme for the lighting of the town. Mr. McClenaghan had asked permission to erect poles for street lighting.

Batley.—PRICE INCREASE.—The T.C., last week, approved the minutes of the Electricity Committee containing an increase in charges for current for power and heating by 27½ per cent. on pre-war rates.

Birkenhead.—WAGES.—The agreement between Wallasey and Birkenhead Councils respecting the wages and conditions of labour of the employés at the respective Corporation electricity works, has been terminated by mutual consent.

Blackburn.—The Corporation has appointed a special Sub-Committee to deal with the question of the necessity of proceeding with the work of constructing the new generating station at Whitebirk.

Bootle.—EXTENSIONS.—The T.C. has agreed to an amended scheme for the provision of additional plant, at an estimated cost of £80,000, subject to the approval of the authorities.

Burton-on-Trent.—PLANT EXTENSION.—Subject to the usual consents, a scheme is to be carried out for electricity extensions at a cost of £42,290. The items which make up this total are as follow:—Turbo-alternator, £19,500; foundation for turbo, £2,000; Babcock & Wilcox boilers, complete with chimney, £9,640; settings, £800; stokers, £2,400; steam pipes, &c., £1,600; switchgear, £3,850; excavating and laying main, £1,500; alteration to roof, £1,000.

Clayton.—PROVISIONAL ORDER.—The U.D.C. has now decided to apply for its own Provisional Order for electric supply.

Cavan.—WORKHOUSE LIGHTING.—In connection with the electric lighting scheme for the workhouse, the engineer estimated the cost of plant at £529, and the clerk said the price of a 27-H.P. plant offered him was £710. It was intimated that a second-hand plant available at Sheffield at £315 might suit, and it was decided that it should be inspected.

Cork.—The Corporation has accepted the services of Mr. J. P. Tierney, of Dublin, to report on the city electric lighting plant.

Dartford.—PRICE INCREASE.—In order to meet the increase of 2s. 6d. per ton on the price of coal, the U.D.C. has increased the price of current for lighting, as from the end of the year, by 10 per cent., making a total advance on pre-war rates of 40 per cent., and for power by 10 per cent., a total rise of 45 per cent.

Darwen.—PRICE INCREASE.—The price of electricity has been increased by 10 per cent., both for motive power and lighting purposes.

Dublin.—WORKING CAPITAL.—The Corporation has adopted a recommendation of the town clerk and the city treasurer that steps be taken to secure legislation to enable the Electricity Supply Committee to borrow for working capital. An amendment for postponement until the report of the electricity undertaking for the period to March, 1916, was in the hands of the members, was rejected by 26 votes to 9.

Mr. J. J. O'Neill, in moving the resolution, said that they had been in debt to the bank £40,000 or £45,000 for the past seven years, but they had had a loan to credit. For the past four years they had borrowed no money, for their borrowing powers were exhausted. The loan being also exhausted, it was natural that the bank should feel uneasy when the £40,000 was owing and no interest payable.

Mr. Ryan said the proposal was one of the most pernicious ever heard in the Council Chamber. The Committee asked to be permitted to pay interest on an overdraft of about £50,000. He did not think the Corporation should have power to pay interest on overdrafts at the bank while money was due to the concern by consumers of current. Why were their debts not collected?

Mr. Foley pointed out that there was a deficit of £52,000 on March 31st, and urged that the Council should have before it the difference between current accounts and the amount of overdue accounts.

Mr. Sherlock said the Committee wanted to borrow money to pay wages and other charges pending the period when the consumers' accounts were paid in. The money had been got from the bank for years; but the bank now said it could not advance the money without interest being paid. The Corporation's experts told them it would be necessary to borrow £50,000 at 5 per cent. Every Corporation in the kingdom had power to pay interest on overdrafts to bankers. He mentioned Edinburgh, Glasgow, Aberdeen, Leeds, Dundee, Rathmines, and other places where electricity had been making a profit in 1914, but where there were now losses, and said an undertaking like their own, which was able to meet increased charges and involve a loss of only £1,600 a year, was one of which they ought to be proud.

Mr. Beattie expressed regret that Mr. D'Alton's expert report on the undertaking had not been adopted. He designated the concern as a miserable failure, and argued that unless there was a complete change of management things would go from bad to worse.

Alderman Quaid said he could not see why the undertaking should be a failure, in view of the way in which it was advantaged.

Mr. Foley said it was unreasonable that £52,000 should be allowed to remain outstanding in one year. He then moved the amendment, which was defeated.

The Dublin Citizens' Association Executive has passed a resolution viewing with alarm the bank overdraft of £50,000 on the electricity undertaking, and protesting against the Corporation seeking powers to pay interest on the overdraft.

Dundee.—In connection with the reference to a Committee of the T.C. of the extension of the electricity department, Mr. Paton moved that the Committee be also instructed to take into consideration the conservation of the national coal supply at present being considered. The proposal was agreed to.

Felixstowe.—PROPOSED E.L. PURCHASE.—The Lighting Committee reports that it is of opinion that the Council should consider the question of taking over the electricity undertaking under the powers contained in the agreement, which was for a term of 25 years from November 11th, 1904, at the end of which the company was to hand the undertaking over; in the meanwhile, with the sanction of the L.G.B., the Council had to provide the capital required for extension. In the event of the Council taking it over at the end of 15 years, it had undertaken to pay to the company a sum of 2½ per cent. per annum, in respect of the unexpired 10 years, on the capital provided by the Council to November, 1919. Up to date the Council had provided £30,000, and 2½ per cent. on that was £7,500. In addition, there was some equipment which might be bought by the Council if it could agree to a price, and which would amount to about £2,000. The Council would have to borrow the money to buy the company out; the preparation and presentation of the case would cost about £500. It was decided to prepare the case for an application to be made to the L.G.B. for sanction to borrow the necessary money.—*East Anglian Times.*

Gloucester.—PROPOSED LOAN.—Subject to approval, the T.C. has decided to apply to the L.G.B. for a loan of £850 for cable extensions to a local works.

Hornsey.—PRICE INCREASE.—The Council has decided that, as from the readings of the meters at the end of the Christmas (1917) quarter, the prices to be charged for electricity for lighting and power shall be increased by the addition of an amount equal to 40 per cent. of the prices charged on August, 1914; and that from January 1st next the increase of 25 per cent. on the meter rents be withdrawn.

Kirkcaldy.—PRICE INCREASE.—The Electric Lighting and Tramway Committee has decided to increase the charges for lighting and power by 25 per cent., being a total increase of 50 per cent. on pre-war prices.

Leeds.—WAR BONUS.—The General Purposes Committee has agreed to advance the war bonus of Corporation employés from 9s. to 15s. per week for men and to 12s. for women, those affected being persons in receipt of not more than £250 per year, and excluding certain members of Trade Unions with whom other negotiations have been completed.

Littleborough.—The suggested alteration of the supply of current to the Littleborough section of the Rochdale Corporation tramways has been approved by the Controller of Electric Power Supply, but he has now intimated that he cannot grant facilities for obtaining cable at the present time. The chairman and engineer are engaged in trying to secure second-hand cable for the purpose.

Liverpool.—LOAN SANCTION.—The City Council has received the consent of the L.G.B. to the borrowing of £52,000 for mains in the Aintree and North End districts.

London. — ISLINGTON. — The Electricity Committee recommends that, commencing with the March quarter accounts, the charges for electricity be increased as follows:—50 per cent. increase above pre-war prices for all energy supplied at 1d. and under per unit; 33⅓ per cent. increase above pre-war prices for all energy supplied to private consumers at any charge above 1d. per unit; charges for public lighting to be increased from 1·54d. to 1¾d. per unit.

The City of London E.L. Co. announces a further 10 per cent. increase in electricity charges, from March, 1918, making a total of 30 per cent. for power and 20 per cent. for lighting and heating on pre-war rates.

STEPNEY.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking for the year ended March 31st last show a total income of £134,867, being an increase of £30,336 over the previous year. The total expenditure amounted to £94,710, an increase on 1916 of £25,421; this left a surplus of £40,156 to be carried to net revenue account, as compared with £35,242 in 1916, and after providing for interest, sinking fund and other charges, there was a deficit of £3,584, as compared with a deficit of £5,864 in the previous year. There has been an increase in the number of units sold from 24,971,891 to 27,011,530, the output being as follows:—Private lighting, 4,349,893 units; power and heating, 10,873,362 units; in bulk for lighting, power and heating, 5,316,376 units; public bulk supply, 6,292,676 units; public lighting, 179,223 units; the total average cost per unit sold was 1·232d., as against 1·055d. in the previous year.

The engineer, Mr. W. C. P. Tapper, in his report states that coal cost 3s. 8d. per ton more than in 1915-16, which, on the year's consumption of 53,630 tons, represented an increased expenditure on this item alone of £9,382; he also points out that the coal bill is enhanced by between 3s. and 4s. per ton due to the fact that all the coal is now rail borne, as a result of the stoppage of supplies by sea, thus entailing extra cost in taking to the Poplar Dock and barging to Limehouse; this represents from £8,000 to £10,000 per annum.

As regards the deficit, which has been transferred to the reserve fund, unless the existing 50 per cent. advance in charges proves sufficient to avoid any further drain on the fund, a complete revision of the Council's tariff will be essential.

L.C.C.—The Finance Committee recommends the sanction of the Council to the borrowing of £38,555 by the Battersea B.C., for a 5,000-KW. turbo-generator and 1,500-KW. rotary converter.

Loughborough.—PRICE INCREASE.—The T.C. has decided to increase the cost of electricity for power by 10 per cent. Alderman Bumpus, moving the resolution, said the increase was necessitated by the extra cost of coal and wages; the revenue account showed that the output of current had increased by over 80 per cent.; the income had increased for the half-year from £3,141 to £5,645, but the charges had also increased by £1,880. The profit had increased from £527 to £1,142; repairs had cost £633. He considered they might look forward to a satisfactory financial return at the end of the year.—*Nottingham Guardian.*

Lurgan.—The Council has referred to a Committee the question of providing electric light at the waterworks, Castor Bay.

Manchester.—PRICE INCREASE.—The City Council has approved the Electricity Committee's proposal that an advance of 20 per cent. be made on the charges for electricity for lighting, industrial power, and domestic power as from the December quarter, 1917. The total war additions are now:—Lighting, 30 per cent.; industrial power, 35 per cent.; and domestic power, 30 per cent.

Monaghan.—WORKHOUSE LIGHTING.—On the B. of G. discussing the lighting of the workhouse, a member remarked that but for the high prices of material they would have had the electric light long ago.

Menston.—E.L. PROPOSALS.—A meeting of the ratepayers is to be called to discuss the terms on which the Electrical Distribution of Yorkshire, Ltd., is prepared to supply electricity to the village.

Nelson.—STREET LIGHTING.—Owing to present conditions, the Electricity and Tramways Committee has declined to consider the question of street lighting by electricity from the tramway standards.

Newcastle-under-Lyme.—BULK SUPPLY.—The Council has decided to submit particulars of the scheme (as submitted by the electrical engineer) for taking a bulk supply of electricity from the Stoke-on-Trent Corporation, to the Ministry of Munitions, the B. of T., and the L.G.B., for their approval, after the same has been submitted and approved by the Stoke-on-Trent Council.

The engineer's proposal for bulk supply was to install a 150-KW. rotary or motor-converter, costing roughly £1,200; mains, 1,325 yards, £1,200; E.H.T. and L.T. switchgear, £400; contingencies, £200; making a total of £3,000. He pointed out that the saving in cost of generation would be more than sufficient to pay interest and sinking fund on the capital expended, as the present fuel cost was nearly ¾d. per unit; also that additional plant would be required shortly to deal with the load in the recently extended borough area.

Oldham.—PRICE INCREASE.—The Corporation has decided that, as from December 25th, and until further notice, the prices of electrical energy will be increased as follows:—(*a*) All lighting rates (with the exception of the flat rate), increase of 15 per cent.; (*b*) all power, heating, and cooking rates (with the exception of cotton mills under agreement), increase of 15 per cent.

Rochdale.—The Corporation has declined an application from the Todmorden Corporation for a bulk supply of electricity, owing to no surplus plant being available.

Rotherham.—SUPPLY DEVELOPMENTS.—The Electricity and Tramways Committee has approved of a report of a joint conference of representatives of Sheffield and Rotherham Corporations that it is desirable that a Committee should be formed, consisting of representatives of the Sheffield and Rotherham Corporations and other authorities interested, and large consumers of electric current, to consider as to the propriety and possibility of the best and most economical production and distribution of electric current in the Sheffield, Rotherham, and surrounding district, and that at the earliest practicable stage in the proceedings the Yorkshire Electric Power Co. and the South Yorkshire colliery proprietors should be brought into consultation.

Sheffield.—Representatives of the Corporation have been appointed on a Joint Committee to consider the question of electricity supply in Sheffield, Rotherham, and adjacent districts. It has been decided to accept an offer received from the North Metropolitan Electric Power Supply Co. to purchase the power factor rectifier now installed at the Sheaf Street station.

South Africa.—A scheme for the electric lighting of Umtali, Rhodesia, has been prepared, and in view of a large flow of water existing in the locality, it is thought that power also will be generated.—*British South Africa Gazette.*

Southampton.—PRICE INCREASE.—The T.C. has further increased the charge for energy for lighting, power, and heating by 20 per cent. as from the meter readings for the December quarter, making a total advance on the pre-war rates of 40 per cent.

Stafford.—PRICE INCREASE.—The T.C. has agreed to a recommendation that the price of electricity should be increased by ½d. per unit for lighting and power, with the same discounts as at present, except that the consumers for power not exceeding 200 units per quarter be returned a discount of 5 per cent. instead of 2½ per cent., and that such increase should take effect from the last reading of the meters during the current quarter.

Wallasey.—BULK SUPPLY.—The T.C. has undertaken to supply electrical energy in bulk to the Hoylake and West Kirby District Council under the B. of T. scheme.

Walsall.—SALE OF PLANT.—In connection with the disposal of old plant, the Council has sold two 500-KW. generators for £6,000; two D.C. generator sets, a condensing plant, and a boiler with stoker for £900; and two economisers and a pump for £598. It is estimated that on the present year's output, the saving in working costs at Birchills compared with the old working costs will be approximately £10,000. A 200-KW. transformer is to be purchased at an estimated cost of £250, and a motor vehicle for the department, at a cost not exceeding £200. The South Staffordshire Tramways (Lessee) Co., Ltd., has agreed to pay an increased charge of 40 per cent. for a temporary additional supply of current given to it, and also to pay a similar advance for the present supply.

Warrington.—PRICE INCREASE.—The Corporation has confirmed the proposal to increase the price of electrical energy for all purposes by 10 per cent. from January 1st next.

Watford.—LOAN APPLICATION, &C.—The U.D.C. has applied to the L.G.B. for a loan of £780 for E.L. purposes. The charge for energy for lighting has been advanced by ½d. per unit, that for power from 10 to 20 per cent., and the existing prepayment meter rental of 1d. per week raised to 2d., from the end of the December quarter. No extra charge is to be made for public lighting.

Wolverhampton.—PROPOSED LOAN.—Application is to be made to the L.G.B. for sanction to a loan of £1,800, being the difference between the estimated cost of additional converter plant and the estimated amount to be received on account of the sale of the last two of the old reciprocating sets. The engineer has also been authorised to purchase not more than three additional canal boats for the conveyance of coal.

TRAMWAY AND RAILWAY NOTES.

Bradford.—A record of accidents to Corporation workpeople during the past year shows 276 of all kinds, of which 15 have proved fatal. The department which heads the list is, not unnaturally the tramways, which has experienced a hundred mishaps. The gas department comes next. The total number for the year is above the average.

Continental.—SWITZERLAND.—According to the financial Press, the figures of the Swiss Budget for the year 1918 have now been published, and it has been agreed to push forward the electrification schemes of the Gothard Railway, for which a credit of 12 million francs is sanctioned. The power stations at Ritom and Amsteg are in course of erection, and work on the section Erstfeld-Bellinzona is in progress.

Glasgow.—ACCIDENT.—Last week a double-deck car overturned, after leaving the track at a sharp corner. The car was crowded, and two persons were killed and 30 injured, one of whom has since succumbed to his injuries.

Kirkcaldy.—It is proposed to link up Kirkcaldy, Kinghorn, Burntisland, and Rosyth by tramway.

Lancashire.—CHRISTMAS DAY SERVICES.—No agreement has yet been arrived at in regard to the tramway service in Manchester and Salford on Christmas Day, though further meetings are to be held this week. The Manchester cars carried half a million passengers last Christmas Day. The Wigan T.C. has decided to suspend its service, in view of the excessive hours worked by employés since the outbreak of war.

Lancashire and Cheshire Wages.—It is stated that an application for still another war bonus will shortly be made by all sections of tramway workers throughout Lancashire and Cheshire. The amount asked for will be 10s. a week, in addition to what is being already paid.

Leeds.—PARCELS DELIVERY.—The Tramways Committee, in response to a request from the Government officials who have charge of the scheme for the co-ordination of road transport that more use should be made of the tramways for the conveyance

of parcels, has appointed a small Sub-Committee to investigate the matter and report to the Committee. At present the tramways do not specially cater for the carriage of parcels, the reasons being that the passenger traffic has been sufficiently lucrative and the desire not to compete with the local carriers. The modified system in operation provides for the carriage of parcels up to half a hundredweight from the city to any part of the system. There is, however, no collection of parcels for delivery in the city except on the condition that such parcels will be called for at the central tramway offices. The main difficulties in the way of an extension of the system are the labour shortage and the problem of distribution, collection, loading, and delivery, constituting a much greater problem than the actual carriage of the goods. The railway companies operating in the city have restricted their areas of delivery during the war.

Manchester.—REVISED FARES.—The revised scale of fares on the Corporation tramways comes into operation on December 16th. On some routes there is no alteration, but generally about 640 yards have been taken off the 1d. stages on the main routes. As the average length of the 1d. stage on the principal routes will be 2 miles 757 yards, the Manchester service will still be amongst the cheapest in the country. At the City Council meeting an amendment to refer the matter back was lost, it being pointed out that increased fares were inevitable if the department was to meet the added cost of working,

Rochdale.—The lighting of the tramway routes by lamps from the tramway standards has led to application for similar privileges from the Whitworth, Littleborough, Milnrow and Norden District Councils. The Tramways Committee has granted the concession, subject to proper safeguards, and at the payment of ·24d. per 100-watt lamp per hour, the work of erection and maintenance to be done at the District Council's expense. The Electricity Committee charges the tramway department 2½d. per unit for these special lighting supplies—double the ordinary tramway traction price.

Stoke-on-Trent.—The local branch of the Amalgamated Association of Tramway and Vehicle Workers has asked for a standard rate of wages for all grades of labour, a maximum week of 48 hours, with overtime at time-and-a-half, and a fortnight's holiday, with pay, after 12 months' service.

Wigan.—At the T.C. meeting recently, it was stated that it had been found that the L.C.C. cars which had been offered to augment the local services were unsuitable. A deputation had interviewed the authorities, and Mr. McElroy, on behalf of the latter, had visited Wigan, and obtained information as to the local position, and the matter of additional rolling stock was now in the hands of the Tramway Control Committee.

TELEGRAPH AND TELEPHONE NOTES.

Batley.—Six Heckwondwike youths were summoned at Batley, last week, for throwing stones at telegraph insulators. Ten insulators were broken. The eldest, a lad of 21, was fined £1, and 3s. costs, and the others had to pay 13s. each.

China.—An agreement has been drawn up and is awaiting the Chinese President's approval between a Chinese and a syndicate described as Danish, by which China grants wireless telegraph rights. The *North Mail's* Peking correspondent fears that the German Telefunken Co. is interested financially and politically—*Daily Mail.*

Dutch Indies.—The Dutch Government has asked for a credit of five million florins for the erection of a wireless station for communication between Holland and the Dutch Indies. The work will be executed by the Telefunken Co., of Berlin. The receiving installation will be ready in three months, and the sending installation in 18 months.

Long-Distance Telephony.—San Francisco papers announce the invention of a new device for the clear transmission of the voice over practically unlimited distances on surface wires or submarine cables by Dr. S. N. Baruch of that city. Experiments have been carried out over wires and cables of lengths varying from 30 to 100 miles and over experimental artificial lines up to distances equal to 3,000 miles, and have given such positive results that engineers of the Government and of two large public utility corporations have interested themselves in the invention. According to Dr. Baruch, his system makes repeaters unnecessary.—*Telephone Engineer.*

United States.—Terms have been settled between the United States Government and the Marconi Wireless Telegraph Co. of America with regard to the remuneration and compensation to be paid to the company in respect of all the company's wireless stations.

CONTRACTS OPEN AND CLOSED.

OPEN.

Argentina.—February 23rd, 1918. Rosario Municipality. Establishment of telephone service within the municipal radius. Conditions on application.

Bolton.—January 15th. Electricity Committee. One 7,500-KW. turbo-alternator with condensing plant. See "Official Notices" December 7th.

Brighton.—December 18th. Electrical fittings for the B. of G.: Mr. Horace Burfield, Clerk, Prince's Street.

Spain.—The municipal authorities of Pruna (Province of Seville) have lately invited tenders for the concession for the electric lighting of the town.

CLOSED.

Bolton.—Electricity Committee. Accepted tender: Messrs. G. & J. Weir, Ltd., for a steam turbine feed pump for the Back-o'-th'-Bank generating station.

Glasgow.—The Tramways Committee has recommended acceptance of the following offers:—

250 steel tires.—H. Bessemer & Co., Ltd.
500 " " Brown Bayley's Steel Works Ltd.
Oils.—Blacklock & Macarthur, Ltd.; Marks & Johnson, Ltd.; J. & D. Hamilton, Ltd.; J. Murray & Son, Ltd.
Chilled Iron Brake Blocks.—Carron Co.

Lancaster.—T.C. Two motor-'bus car bodies. Mr. Jas. Hardy, Lancaster. £245 each.

Sheffield.—City Council.—Accepted tenders for the Electricity Department:—

J. W. Harrison, Ltd.—Cast-iron pipes.
A. Reyrolle & Co., Ltd.—Further 30 panels of extra H.T. sub-station switch gear.
Foster Bros., Ltd.—Pipework.
Edward Bennis & Co., Ltd.—Suction ash plant.
R. White & Sons.—Lifts and rails.

Swansea.—Corporation. Six tenders were opened for the supply of the 5,000-KW. turbine plant necessary for extensions in the borough, and that of the British-Thomson Houston Co., Ltd., was accepted, at £25,516. Cables and other accessories will have to be obtained, and application is to be made to the L.G.B. for sanction to raise a loan of £42,000 for the purpose.

Wolverhampton.—Corporation Electricity Committee. Accepted tenders:—

British Thomson-Houston Co., Ltd.—Spare parts for telpher plant, £133.
Stirling Boiler Co.—Duplicate stoker, driving shaft and reduction gear, £94.
G. & J. Weir, Ltd.—Two turbine-driven boiler feed pumps, £480 each; spare parts for present pumping set, £46; two special Hydrokineter nozzle heaters, £44; two non-return valves for Weir pumps, £36.
Reyrolle & Co., Ltd.—Spare oil switch, £82.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, December 14th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Use of Soap Films in Solving Torsion Problems," by Mr. A. A. Griffith and Mr. G. I. Taylor.

Electro-Harmonic Society.—Friday, December 14th. At 8 p.m. At the Holborn Restaurant (Venetian Chamber). Smoking Concert.

Greenock Electrical Society.—Saturday, December 15th. Visit to Glasgow Central Station.

Thursday, December 20th. At 7.45 p.m. At 22, West Stewart Street Discussion on "Fuses and Circuit Breakers," opened by Messrs. McDougall and Toppin.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, December 15th. At 3 p.m. Visit to Messrs. Mavor and Coulson's Works, Glasgow. Concert at Trades House Restaurant, 89, Glassford Street.

Society of Engineers.—Monday, December 17th. At 5 p.m. At the rooms of the Geological Society, Burlington House, Piccadilly, W. Lecture by Mr. Chalmers Kearney on "High-speed Railways after the War."

Junior Institution of Engineers.—Friday, December 14th. At 6 p.m. At 39, Victoria Street, S.W. Paper on "Rotary Engine and Rotary Pump," by Dr. W. E. Lilly.

Saturday, December 15th. At 2.45 p.m. Visit to the Britannia Pencil Works, Neasden.

Monday, December 17th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Engineering in the Brewing Industry," by Mr. C. R. Turner Adjourned annual meeting.

Royal Society of Arts.—Monday, December 17th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor Lecture on "Progress in the Metallurgy of Copper" (Lecture III), by Prof. H. C. H. Carpenter.

Wednesday, December 19th. At 4.30 p.m. Paper on "The Cold Storage Industry," by Prof. J. Wemyss Anderson.

Illuminating Engineering Society.—Tuesday, December 18th. At 5 p.m. At the Royal Society of Arts, 18, John Street, Adelphi, W.C. Presidential address by Mr. A. P. Trotter.

Institution of Civil Engineers.—Tuesday, December 18th. At 5.30 p.m. At Great George Street, S.W. Paper on "The Buenos Aires Western Railway Tunnels under the City of Buenos Aires," by Mr. W. L. L. Brown.

Institution of Electrical Engineers.—(**Newcastle Local Section**).—Thursday, December 13th. At 7 p.m. At the Mining Institute. Presidential address.

(**Yorkshire Local Section**).—Tuesday, December 18th. At 7 p.m. At the Philosophical Hall, Leeds. Paper on "Electrical Cooking as Applied to Large Kitchens," by Mr. W. A. Gillott.

Liverpool Engineering Society.—Wednesday, December 19th. At 8 p.m. At the Royal Institution, Colquitt Street. Paper on "The Need for Research Work on the Propulsion of Full-sized Ships," by Mr. A. T. Wall.

Belfast Association of Engineers.—Thursday, December 20th. At 7.45 p.m. At the Municipal Technical Institute. Paper on "Electro-metallurgy," by Mr. G. L. Roslyn.

NOTES.

£300 Wanted at Once.—An effort is being made to bring up the invested funds of the Electrical Trades' Benevolent Institution to £10,000 before the close of the year. The following is a copy of a letter issued by the Secretary (Mr. F. B. O. Hawes) to certain members of the industry. As will be observed, £300 is the sum required, and we earnestly hope that it will be forthcoming. The trade has not been worried by this Institution very much of late, owing to the war; but its needs will be pressing when hostilities come to an end, and we appeal for a Christmas response, so that the five-figure total may be reached. The address of the Secretary is as given below, and he will gladly receive any help that readers have it in their heart and in their power to render. Thoroughly believing in this excellent organisation, we strongly recommend it to the sympathy of all. We shall be pleased to pass on to Mr. Hawes any donations or promises that may be sent to us here by letter, by 'phone, or by telegraph:—

"Dear Sir,—At the last annual general meeting of this Institution Mr. Campbell Swinton contributed a gift of £100 in the hope that by a few others following his example, the funds might this year reach a figure exceeding £10,000. With this object also Sir David Salomons has increased his liberal regular contribution by a further gift of £20.

"The present invested funds are far too small to meet the calls for pensions and temporary assistance which will doubtless be made soon after the War.

"My Committee are very anxious that the £300 required should be obtained before the end of the year. May I ask for your assistance?—Yours faithfully,

"F. B. O. Hawes, *Secretary.*

"18-21, Park Mansions, Vauxhall Park,
"South Lambeth Road, London, S.W.
"*December 12th*, 1917."

Mischievous Sport.—At the Wakefield local Court, last week, three youths were fined £1, and 5s. costs, for throwing stones at an electric arc lamp. The police said that during the past six weeks £9 4s. 11d. worth of damage had been done to electric lamps in a certain neighbourhood, in addition to damage to gas lamps.

Volunteer Notes.—County of London Volunteer Engineers (Field Companies).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C.B. Clay, V.D., commanding:—
Officer for the Week.—Second Lieut. F. Gaywood.
Drills.—Week ending Friday, December 21st, 1917:—
Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.
Tuesday.—Physical drill and bayonet training, 7.30.
Wednesday.—No. 1 Company, 6.30.
Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.
Friday.—No. 3 Company, Right Half. Recruits, 6.30.
Musketry.—Belvedere Road, Tuesday, Wednesday, and Thursday, 5.30 to 7.
Note.—Christmas Holidays: Headquarters and the Range will be closed from the 22nd to the 28th, both inclusive.
The Medical Officer will attend for examination of recruits, &c., on Thursday, at 6.30.
Unless otherwise indicated, all drills will take place at Headquarters.
(By order) Macleod Yearsley, *Capt. and Adjutant.*

Decimal Coinage.—In an excellent little pamphlet just issued by the Decimal Association, after recording the consensus of opinion on the part of the Institute of Bankers, the Association of Chambers of Commerce of the United Kingdom, and the Decimal Association in favour of the adoption of the pound sterling as our monetary unit, divided into 1,000 mils, the Association gives the following reasons why the present is an opportune time for making the change:—

1. Relief to the poorer classes would be afforded by the substitution for our present "penny" coinage of the more finely graded "mil" coinage, which would inevitably result in a closer relation between the cost and the price of food and other daily necessaries bought in small quantities.

2. Under the new system all prices and charges now expressed in pence would be quoted in mils, and the present period of fluctuating values is obviously a most opportune time for making the small adjustments incidental to this change of practice.

3. Millions of our people are now obtaining practical first-hand experience in the use of coinage arranged on a decimal basis, this being the basis already adopted by all our Allies.

4. The withdrawal from circulation of the crown, half-crown, and threepenny piece would afford some relief at this time of abnormal shortage of silver.

5. The present close co-operation between the Government and the owners of public and semi-public services gives a favourable opportunity for the speedy adjustment of such tolls, fares, &c., as are now fixed by Statute.

Belfast Arbitration.—At a meeting of the Belfast Tramways and Electricity Committee, last week, a letter was read from the Electrical Trades Union on the subject of the application of an award of Mr. Doughty, K.C., in the matter of an arbitration between the Union and the National Federated Electrical Association, representing the Belfast employers and contractors, and a communication from the Electrical Contractors' Association having been read to the effect that the award had been complied with in so far as their members were concerned, the advance was ordered to be paid, pursuant to the Council's Standing Orders. A further letter was read from the Electrical Trades Union on the subject of the application of the 12½ per cent. bonus award, and the consideration thereof was held over for further information. A letter was also read from the district secretary of the Amalgamated Society of Engineers, transmitting copy of an award of the Committee on Production in relation to their recent application, and the consideration of it was held over pending a further communication being received from the Belfast Employers' Association on the subject. The Committee had under consideration the question of the provision of additional plant at the electricity station, and ordered a communication to be addressed to Sir John Snell on the subject.

Water Heating by Electricity.—On November 2nd, Mr. W. J. Wilson gave a lecturette on "Electric Water Heating," before the Junior Institution of Engineers. He pointed out the obvious advantages of using electricity for heating and cooking in respect of cleanliness and reduction of work. The heating of water on a large scale, say, for baths, has, however, some drawbacks, and there are some problems to be solved before the best results can be obtained. One of the main drawbacks—not inherent in the apparatus itself—is the price of electricity. At lighting rates water heating in bulk is not a commercial proposition.

Electric heating systems may be classified as follows:—(1) Thermal storage; (2) geyser; (3) separate hot water tanks; (4) circulating systems with storage tanks. In these the design is influenced by the desirability of running the apparatus constantly in order that advantage may be taken of the cheaper electricity rates which are available for sustained and steady loads.

The Therol heater (Class 1) is designed to run 24 hours per day, *i.e.*, it has a 100 per cent. load factor. A heater taking 200 watts delivers 20 to 30 gallons of water at 110° F. per day, or 9 gallons at boiling point.

The Losles heater (Class 1) is controlled by a thermostat, so as to maintain the water at any desired temperature from boiling point downwards. The 10-gallon size can give 20 gallons per day at 200° F., and is rated at 500 watts.

The Ferranti heater (Class 1) is generally arranged to take 350 watts, and is capable of raising 38 gallons through 60° F. in 24 hours. By means of an arrangement of slow circulation of water it is possible to obtain boiling water from this heater in one hour.

The first class of heater is useful only where the demand for water is more or less continuous, but not for such work as baths, for example. It cannot deal with this type of service unless excessive storage is provided, with its inevitable high heat losses. It has no emergency valve, and a very small leak may seriously affect its efficiency.

The electric geyser (Class 2) is the quickest heater, but its loading has to be heavy, and switchgear becomes a serious item. For example, with water flowing at a rate of 5 gallons per minute, 40 KW. would be required to raise the temperature through 54° F. For ordinary lavatory use a geyser to supply hot water requires from 5 to 8 KW.

For a succession of baths it is best to provide a separate hot-water tank (Class 3). A standard pattern in use contains 15 gallons, and is provided with an immersion heater taking about 10 KW. In this the 15 gallons can be raised through 90° F. in 20 minutes, and, allowing 20 minutes per bath, the bath can be kept in constant commission. The consumption of energy for three baths is thus 10 units.

A thermostatic control can be fitted to this type of heater, and this, assisted by a clock-switch and electric bell, can work wonders in a lazy bachelor's flat.

The fourth class of heater is inefficient, although giving no trouble in working. Large heat losses are inevitable in any circulating water system. With bare pipes and water at 130° F. the loss may be, say, 34 watts per sq. ft. In 24 hours 250 ft. of 1 in. pipe would lose 72 units. Efficient lagging may reduce this loss by 60 per cent. or 70 per cent.

Electric apparatus being so clean, convenient and reliable, quite a profitable load of respectable dimensions may be obtained by a supply station, provided that energy is supplied at a reasonable price.

Birmingham Corporation Electrical Employes.—The Birmingham Corporation Electricity Committee and representatives of the Electrical Trades Union are holding a meeting to consider demands made by the Union on behalf of the electrical workers that they shall participate in the awards applicable to the Union and not in the usual municipal advances. It is stated that the demand was lodged in November by the Birmingham district secretary of the E.T.U. on behalf of youths and men who were formerly members of the Gas, Municipal, and General Workers' Society and have been admitted to the E.T.U. The secretary (Mr. Beardmore) also applied for 25 per cent. proportionate extra salary for all periods of night shift work, for shift engineers, for switchboard attendants, and for assistant switchboard attendants employed at the generating stations; and for time and a quarter for night shift for attendants and assistants at sub-stations.

"This is equivalent to a demand for the recognition of all these men as engineers, and if conceded would have entitled them to participate in all the awards made to skilled workers by the Committee on Production instead of waiting for concessions made to the general body of municipal workers.

"On December 3rd, however, a letter was received by Mr. Beardmore from the Department, declining to recognise the claims of these men apart from the general labourers of the Corporation, and when this letter was presented to a meeting of the Birmingham Station Engineers' Branch of the Union, of which all the men affected are members, it was decided to instruct the general secretary to adopt all possible methods to secure their demands.

"Mr. Beardmore, thereupon, forwarded notice of the intention of the men to cease work if their demands are not conceded by the 14th inst."—*Birmingham Gazette.*

Legal.—Electrical Installations, Ltd., *v.* Ede and Townsend, Ltd.—In the Lord Mayor's Court, on December 10th, before Assistant Judge Jackson, sitting without a jury, this case was heard and disposed of. The plaintiffs, electrical engineers of Martin's Lane, E.C., sued the defendants, printers, of Tabernacle Street, for £25, balance of account for work done and material supplied in connection with an electrical installation at the defendants' premises. The defendants early in the present year were moving from premises in Southwark Bridge Road to Tabernacle Street, and the plaintiffs were asked to adapt an electric installation at the latter premises, to bring it up to date, and make it suitable for their (defendants') requirements. This the plaintiffs did, at a cost of £55. The defendants had paid £30 on account, leaving the balance sued for due. The defendants counter-claimed for a sum of £4, alleging that that sum was paid to the plaintiffs for work done, which they had not carried out. Walter James Hayward, assistant engineer to the plaintiffs, said he supervised the work carried out by his firm on the defendants' premises. He had discussed the matter of adapting the installation on the premises as much as possible, with Mr. Tomlin, of the defendant firm, and had pointed out that it would be preferable to put into the premises an entirely new installation. An experienced mechanic was put on the job, which took about ten weeks to complete. Edward William Clifton, electrical fitter, who carried out the work for the plaintiffs, said that during the time he did the work there was no complaint that he was wasting time. He found that the installation he had to work upon was done by amateurs from time to time, and a great many of them. He had never seen such wiring before, and the whole of the lighting was on one circuit. He had made four new circuits, and bunched what remained on three other circuits. The job was made up to date as far as it was possible. Alfred Tucker, manager of the plaintiffs' maintenance jobbing department, said £8 6s. was the net cost of materials used by them on the defendants' work and £30 2s. 3d. paid for labour; 33⅓ per cent. was added to cover establishment charges. The charge for labour seemed a little out, but upon inquiry he found there had been a good deal of "testing labour," which would not have been required in putting up an entirely new installation. When the account was sent in to the defendants they complained that it was exceedingly vague, and that the only thing definite was that it was for £55 0s. 6d. They asked for details, which were given. For the defence, Mr. William Ede, managing director of the defendant company, said that the plaintiffs held an electrical maintenance contract from them while in their old premises in Southwark Bridge Road. When moving to Tabernacle Street they desired the existing electric installation in the portion of the premises they were occupying to be adapted to their use. He saw a representative from the plaintiffs, who he thought was a traveller, and got an idea as to the cost of the work. When the plaintiffs' account came in, however, he thought the charges made by them were excessive, and payment was refused. Mr. Kirk, electrical engineer, and Mr. George Edward Vigor, partner in the firm of G. H. Boyd, builders and decorators, were called to speak as to the overcharges in the plaintiffs' account. The Assistant Judge, after hearing the evidence, gave judgment for the plaintiffs on their claim for £20 6s. 9d., and on the counter-claim, with costs.

L.C.C. and Vehicle Charging.—The General Purposes Committee has had under consideration a communication from the Commissioner of Police with regard to street fittings for supplying fuel, energy, &c., to motor vehicles, and has referred the matter to a number of other Committees, which have reported against the proposals. As this matter is of great future importance to electric vehicle users, the objections which we reprint below will be studied with interest, and no doubt assessed at their true worth :—

1. Motor vehicles waiting at supply points along tramway routes would compel slow-moving traffic to move on to the tramway tracks, thus causing obstruction to fast traffic and greatly increasing risk of accident.

2. The standing of motor vehicles, especially in the case of large vans, pantechnicons, &c., would obscure the view of pedestrians crossing the road, and would be a fruitful cause of accidents.

3. Any supply points situated near tramway stopping places would obstruct and cause danger to pedestrians entering or leaving the tramcars.

4. The width of footway in many thoroughfares is already so narrow that pedestrians overflow into the carriageway, and the adoption of the proposed scheme would increase the danger arising on this account.

5. The main thoroughfares of London are of such dimensions that supply depôts would cause obstruction.

Exit Gas Heating.—Dr. Waldo, Coroner for the City and Southwark, advises those who preside over courts of justice, and who suffer from malaise, to have samples taken of the air, and to look to the heating arrangements. Pointing out that the temperature in his two Courts recently could only be raised to 48° and 52° respectively, he remarks :—"Such a temperature cannot be endured in comfort by people sitting still. A temperature of 66° is required by people of middle age or above it."

The L.C.C. chemist, Mr. Coste, analysed the air at the Southwark Court, and found that the gas radiators loaded the air with ten times the normal amount of carbon dioxide and gave off an irritant gas, as well as aqueous vapour.

Dr. Hartley (St. Bartholomew's) also reported the presence of carbon monoxide, a highly poisonous gas, "which," observed the Coroner, "gives rise to headache, lung irritation, and other symptoms."

The gas radiators have now been replaced by electric stoves.—*Daily Chronicle.*

Books for British Prisoners of War.—We have received from Mr. A. T. Davies, chairman of the "British Prisoners of War Book Scheme (Educational)," Victoria and Albert Museum, South Kensington, S.W. 7, a brochure giving a further account of the working of the scheme, the purpose of which is to provide "interesting and *purposeful* occupation to men for whom such occupation is a matter of vital necessity," to prevent their demoralisation by the *ennui* of prison life. Books have been sent to over 200 prison camps; books have been provided in 44 languages, and dealing with some 115 subjects. In the nine months from January to September, 1917, 6,500 requests for books were received from prisoners, and 7,500 parcels of books were dispatched, including some 43,700 educational books. The present rate of expenditure is £250 per month, of which ⅘ is represented by purchases of books, and a standing stock of at least 12,000 volumes has to be kept at South Kensington. Numerous letters testifying to the immense benefit derived by our captive brothers from these books are extracted in the brochure, and it is stated that £5,000 is needed at once—there are 500 camps not yet covered. Donations are earnestly requested; if these take the form of books, a list, giving dates or editions, should first be sent. Great assistance can also be rendered by local effort, and those who wish to send books to friends in prison can use the scheme for the purpose. The following are a few of the subjects on which books are asked for :—Management of Dynamos; Switchboards; Practice of Electric Wiring (Munro); Switches and Switchgear; Electricity (Hobart); Practical Wiring (Metcalfe); Electricity (Kapp); Electric Lifts and Cranes; Dynamos; Alternating Current; Electric Tramcar Driving; Electric Motors; Electric Fittings; Small Dynamos and Motors.

Electric-Light Switching.—Sixth Batch Exam.—As the advanced-grade results had to be got out first, and as much work remains to be done in completing the examination of the numerous intermediate and preliminary papers, the previous publication of the advanced-grade passes has been thought advisable, especially as many of the examinees have been waiting for some time. These results are given below. The complete results will be published during January or February.

Advanced Grade.—The names are given in order of merit. Six book prizes and certificates :—

H. C. Wilkinson, Wh.Sc., Stud.I.E.E. (Portsmouth).
F. W. Goodenough, Lance-Corporal R.E. (Isle of Wight).
T. R. Priest (Birmingham).
C. L. Drury (Derby).
N. A. Jassawalla, L.M.E., Bombay (Karachi, India).
J. W. Platt (Manchester).
H. C. Whitfield (Burslem).
T. H. Ingle-Scott, I.E. Telegraphs (Karachi, India).

The names in italics above and below denote the gaining of an advanced certificate for the second time, this fact debarring the examinee from taking a prize.

Certificates.—*H. Grimshaw* (Goldborne, Lancs.), *T. C. Hodges* (London, W.), A. V. Cattrell (Barrow-in-Furness), D. Cairns (H.M.S. *Royal Oak*), T. J. Trewitt (South Shields), T. C. Long (Bristol), R. F. Galea (Malta), S. E. Reason (London, E.), T. Wheatley (West Lothian, Scotland), W. C. Larkman-Tayler (Croydon), W. Maddock (Warrington), M. Yusif (Upper Sudan, Egypt), W. H. Gregory (Melbourne), F. Townsend (Cape Town). Twelve competitors failed.

A new advanced-grade paper is just being published, and may be had on request from Messrs. A. P. Lundberg & Sons, 477—499, Liverpool Road, London, N. 7.

Institution and Lecture Notes.—Royal Institution.—The following are amongst the lecture arrangements before Easter :—Prof. J. A. Fleming, a course of six experimentally illustrated lectures, adapted to a juvenile auditory, on "Our Useful Servants: Magnetism and Electricity," commencing December 27th. Sir R. T. Glazebrook, two lectures, on "The National Physical Laboratory." Prof. Sir J. J. Thomson, six lectures, on "Problems in Atomic Structure." The Friday meetings will commence on January 18th, when Prof. Sir James Dewar will deliver a discourse on "Studies on Liquid Films."

Institution of Electrical Engineers.—At the meeting of the Newcastle Local Section, to be held on Tuesday next, there will be a reception by the president of the Institution, Mr. C. H. Wordingham, with the chairman of the Local Section, Mr. A. H. Marshall, followed by an address by the president. A good attendance is specially hoped for.

The Award of the Committee on Production.—Mr. H. Faraday Proctor, hon. secretary of the I.M.E.A., has forwarded to the engineer members of the Association copies of correspondence which has passed between him and the Committee on Production with regard to the date from which the award of 5s. per week is to be paid. The Committee states that the advances granted under the award of November 6th for the engineering and foundry trades are first payable on the pay-day for the first complete pay-week in December. If, for instance, the pay-week commences on a Thursday, then the first complete pay-week in December commences on the 6th, and the advances are payable for the week ending December 12th.

Fatality.—At an inquest into the death of G. M'Intosh, 72, which followed injuries received in the electrical power station, Laganbank Road, Belfast, the jury returned as their verdict that deceased died from fracture of the cervical column caused by the accidental falling of a boiler plate; the accident was caused by a defective bolt, the property of the Corporation.

New Methods of Electrical Treatment.—The medical correspondent of the *Daily Mail* states that "the best equipped electrical workshop in Europe for repairing injured soldiers" was the description an R.A.M.C. colonel recently applied to the Radcliffe Infirmary at Oxford.

An electrical apparatus which totally numbs the severest nerve pains, while, at the same time, gradually bringing about a permanent cure, a machine which will cure acute "water on the knee" in one 20-minute "exposure," and another which charges the patient up like a storage battery, are a few of the wonders shown to the correspondent.

A young soldier suffering from ceaseless pain in one hand, caused by an obscure injury to a nerve, was treated by an ordinary-looking electric battery from which two wires led, one being held in the injured hand and the other attached to a metal plate at the back of the neck. The current stops the pain in the hand, the periods of freedom increasing after each treatment.

For the removal of wasting growths a patient is connected with a special type of battery. When he is "fully charged" the operator brings a needle-pointed metal instrument almost into touch with the tissue to be removed. A flame of electricity jumps from the patient to the instrument, and the growth is instantaneously destroyed. Through the free passage afforded to heat rays, the germ in the growth is literally "cooked" by the electric discharge being concentrated on so small an area, thus producing a high current density. The effect can be seen during an operation as a grey coagulation or destruction of the tissue.

The problem of how to exercise electricity on paralysed muscles without unduly stimulating the healthy ones has been solved by means of a newly perfected system of condensers, which causes the injured muscles slowly to contract and relax, while the healthy ones remain quiescent.

Rathenau and an Enduring Peace.—In our issue of January 26th, 1917, we quoted an article by Dr. Walther Rathenau, of the A.E.G., on preparations, "in the economic sense," which must be made for "the next war." "When the next war comes it must not be a year too soon." The well-known electrical magnate has just been addressing the annual meeting of the A.E.G., in Berlin, and what he now seems to desire is an "enduring peace." A Reuter telegram from Amsterdam, published in the *Times*, quotes the following from his speech :—

"The war has entered the state of liquidation. The climax is past. The British thought that the war could be regarded as only a sum in arithmetic, and that in a given period an entirely isolated country must have exhausted its war supplies and be forced to give up the war, but no material exhaustion is to be feared in Germany. Human and moral factors, resolution, organising will and self-confidence, are stronger factors than mechanical powers. Lord Lansdowne's letter displays the reawakening of a spirit of soberness and moderation. Our foreign affairs are in strong hands, which we trust, and I hope that the political liquidation will be ended so that an enduring peace may be assured."

The Non-Ferrous Metal Industry Bill.—The House of Commons, on Tuesday, resumed the discussion of this Bill. Several speeches were delivered criticising the measure. Its supporters held that it was essential to prevent foreign merchants from getting control of the metal merchants of this country, and that we were only protecting our own interests when we took steps to deprive Germany of the power of control. One speaker said that the discussion raised the question whether or not we meant to retain control over our essential key industries. Mr. Runciman criticised the Bill on various grounds, and wanted it, after second reading, to be referred to a Select Committee. Mr. Bonar Law ultimately replied at length. He said that if we were to attempt to eliminate German influence from the essential industries, we must have safeguards of the kind proposed, and some Government Department must take the matter in hand. The Bill was based on one of the Paris Conference resolutions, which were all drafted by Mr. Runciman. Mr. Bonar Law showed how the Germans had exercised their power. Our enemies must be let to know that we should not hesitate to use our powers to get rid of German penetration in this matter. The main question at the end of the war would be the supply of raw materials. They would be scarce in every industry. The longer the war lasted, the less there would be to go round, and as the Allies would help themselves first, the less there would be for Germany of essential commodities. In order to have independence at home, they must get rid of German control. After further discussion, the amendment moved by Sir F. Banbury rejecting the Bill was lost by a majority of 103 votes. The Bill was then read a second time, and by a majority of 76 was referred to a Committee of the whole House.

Christmas Fire Warning.—The British Fire Prevention Committee has issued a special warning in connection with Christmas entertainments in hospitals, camps, private assemblies, &c. The danger of ignition of dry evergreens, Christmas trees, paper lanterns, cotton wool, celluloid, &c., is pointed out, and the public are warned not to make the slightest change in electric wiring without consulting a competent electrician or an electrical inspector. Buckets of water should always be available, and stout blankets are useful for smothering incipient fires.

Copies of the "Warning" (No. 22*a*) are obtainable gratuitously from the Committee at 8, Waterloo Place, Pall Mall, London, S.W. 1, upon written application, with the necessary return postage enclosed.

Copper from America.—Professor H. C. H. Carpenter, of the Imperial College of Science, speaking at the Society of Arts, on Monday, said the demand for copper during the war had been enormous. It was impossible to estimate the aid given to the Allies by the copper manufactures of the United States, for so far no substitute for the metal at an equivalent price had been found. It was calculated that last year the United States produced 860,000 tons of copper, compared with 592,600 tons in 1912.—*Morning Post.*

Budapest without Light.—A Reuter dispatch from Zurich says that the whole of Budapest has been entirely without gas since last Friday evening, when the supply was suddenly cut off, and the whole city plunged in total darkness, as the electric street lighting was suspended two years ago. The gasworks stoppage was due to the use of inferior Prussian coal, which choked the retorts.

Appointments Vacant.—Charge engineer for the Paisley Corporation Electricity Department; costs and stores clerk for Worcester Corporation Electricity Works; charge engineer (£110 +) for the York Corporation Electricity Department; station superintendent for the Stalybridge Joint Tramways and Electricity Board; commercial secretary (£300) for the Borough of Wolverhampton Electricity Department; junior shift engineer (52*s.*) for the Borough of Stockport Electricity Department; power-superintendent (£200) for the City of Birmingham Gas Department; assistant engineer for the Bootle Corporation Electricity Works. See our advertisement pages to-day.

Steam Turbine Accidents in the United States.—A recent issue of *Power* contains some interesting statistics relating to the more serious accidents which have occurred to turbo-electric plants in the United States, apparently during the past eight years or more.

This is a subject on which both users and manufacturers are naturally disinclined to invite publicity, although much valuable information on the causes of accidents is obtainable from the records of failures and breakdowns of machinery.

Of the accidents cited by our contemporary, 19 were stated to be due to "explosion"; of these, two were definitely attributed to excessive steam pressure; three others to "over-speed"; while a fourth—in which a rotor burst—could be credited to the same cause, and it would be interesting to know what proportion of the remaining unspecified cases of "explosion" were due to over-speed, which figures as the cause of two further accidents not classified as "explosions," though evidently having serious consequences.

Seven cases of blade stripping are mentioned, due to shaft deflection, the presence of foreign substances in the machine, &c., the results being much less serious than in the accidents previously mentioned.

In addition to the above, 11 miscellaneous accidents are recorded, including three of turbine sets destroyed by unspecified causes; two due to pieces of rotor breaking off and jamming; one due to oil failure at a step bearing; another to generator case distortion; another in which the shaft was thrown out of its bearings, and two unspecified accidents.

In a great many cases the turbine or generator, or both, were completely wrecked.

All the cases except one relate to American plants, the exception being at Trieste. The most serious cases of loss specified were at Baltimore, where two large turbines owned by a railway company exploded, causing $260,000 loss, while a third vertical turbine in the same city, belonging to a light and power company, also exploded (due apparently to the failure of a relief valve), causing $175,000 loss; at Los Angeles (Cal.), three turbines wrecked by one explosion resulted in an estimated loss of $250,000.

Although the list is a lengthy one, and not complete, it covers a number of years; it was apparently supplied to our contemporary with a view to refuting a statement by a correspondent that turbine explosions due to over-speed or over-pressure in the lower stages had been few and far between.

The Use of Inland Waterways.—The County Purposes Committee of the Common Council of the City of London has considered the recent letter of the Canal Control Committee, urging manufacturers and traders to increase their use of our inland waterways, and has expressed its cordial approval of the proposal, adding the opinion that it will be to the great advantage of the trading community if the inland waterways are unified and improved with a view to their extended user. The latter object can best be attained by the construction of a central authority, with Parliamentary powers, to take over and develop the existing system of inland waterways on the lines of the Port of London Authority Act, 1908, with such modifications as are considered necessary to meet the circumstances. The Committee further recommends that the Government be urged to give effect to the recommendations of the Royal Commission appointed in 1906 to inquire into and report upon the Canals and Inland Navigations of the United Kingdom.

The A.S.E.—The funds of the Amalgamated Society of Engineers have increased this year to over two million pounds. The membership is 270,000.

A private delegates' meeting of the Society was held on Tuesday, to consider a suggested amendment of the constitution to enable fusion with other Unions desirous of affiliation, thus facilitating joint action in matters of common interest.—*Times.*

Inquiries.—Makers of traction armature coils are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The employés of the Leigh Corporation electricity works presented Mr. A. T. SMITH, the borough electrical engineer, with a gold wristlet watch as a token of their regard and esteem, on his appointment to the British Dyes, Ltd., Huddersfield.

Darwen Town Council has decided to release its tramways manager, Mr. F. J. S. HOSKENS, to enable him to accept an appointment as assistant dilution officer under the Ministry of Munitions at Manchester. He will retain his position as manager, giving attention to the department in the evenings, without salary. The arrangement is an experimental one, and is for a period of three months.

Leigh (Lancs.) Electricity Committee, from 111 applicants, has appointed Mr. J. B. HUDSON, deputy electrical engineer of Bootle, as electrical engineer of Leigh, at £300 a year.

Aberdeen Council has advanced the salaries of Mr. R. HUNTER, station engineer, and Mr. A. H. M'KAY, mains superintendent, from £250 to £280 as from November 1st, with a further increase of £20 next year.

The South Shields Electricity Committee recommends advancing the salary of the electrical engineer by £50 per annum.

The salary of Mr. C. W. COOKSON, accountant and collector to the Walsall electric supply department, has been increased from £188 to £214 per annum.

The following increases of salary have been approved by the Establishment Committee of Sheffield City Council in connection with the new power house:—J. R. Williams, assistant station superintendent, Kelham Island, to be resident constructional engineer at a salary of £275 (including £25 increase); S. Newton, shift engineer, Kelham Island, to be assistant station superintendent at a salary of £225 (including £25 increase), rising to £250 in 12 months; E. Atkinson, shift engineer, Neepsend, to be assistant station superintendent at a salary of £250 (including £50 increase).

The Erith U.D.C. has advanced the salary of Mr. J. C. WILLIAMS, the electrical engineer and tramway manager.

The Birmingham Electric Supply Committee has reduced the number of applications for the position of secretary to the department, in place of Mr. Howard Foulds, to three. A recommendation will shortly be made to the City Council.

The Worcester City Council has approved the following advances, on the recommendation of the Electricity Committee:—Charge engineer, from £141 per annum to £3 per week, and 5s. war bonus; another charge engineer from £133 18s. to £2 15s. per week, and 5s. war bonus; chief assistant and mains superintendent, from £225 to £250 per annum; station superintendent, from £205 to £230 per annum.

The Burton-on-Trent Electricity Committee has decided that the remuneration of the charge engineers be increased from £150 16s. to £165 per annum, and that of Mr. C. J. Melbourne be increased from £217 to £240 per annum.

Mr. W. S. VIGNOLES, Grimsby borough electrical engineer, has been gazetted Lieutenant-Colonel. Mr. Vignoles, who was attached to the local Volunteers, offered his services at the outbreak of war, and went out to France in 1916.

Sergeant NUTTALL, who was a member of the Grimsby Corporation electricity staff, has been awarded the Military Medal.

The Tunbridge Wells Corporation has decided to raise the salary of Mr. G. A. POWNALL, the chief assistant engineer, by £50—£20 now, and two yearly increments of £15.

General.—Congratulations and good wishes to Captain HENRY M. LEAF, D.S.O., R.M.A., formerly of the London Electrical Engineers, on the occasion of his marriage to Miss A. M. E. Cust, which took place at Chelsea on Tuesday last.

Swansea Corporation Electric Lighting Committee has unanimously re-elected Mr. ALEX. SINCLAIR Chairman for the ensuing year, and Ald. GEO. COLWILL Vice-Chairman.

Mr. E. T. SHALDERS, on leaving the Sterling Telephone Co., Ltd., Dagenham (Essex), has been presented by the staff and employés with a suit case, and a wristlet watch for his wife.

On the occasion of his marriage to Miss Gertrude Willats Smith, daughter of Mr. J. A. Smith, of Holmwood, Great Baddow (Essex), Mr. ALFRED EDDINGTON, A.M.I.E.E., assistant manager to the Marconi Co., Ltd., Chelmsford, has been presented by the Chelmsford and London staffs with a silver tea and coffee service, with trays.

A commission in the Egyptian Labour Corps has been given to Mr. ALBERT ARTHUR PRESTON, district superintendent of the electrical department of the Soudan Government Railway at Port Said, and formerly of the North Staffs. Railway electrical department at Stoke-on-Trent.

Mr. J. E. DOBSON, London office manager for Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, was married on December 6th, at Westbury-on-Trym Parish Church, to Vera Maud, only daughter of Mr. and Mrs. Willie James, of Glenthorn, Westburn-on-Trym, Bristol. A few days previously Mr. Dobson was presented with a clock as a souvenir of the occasion from his friends in the firm.

Roll of Honour.—The Military Medal has been awarded to Corporal J. A. BARLOW, Machine Gun Corps, an employé in the public lighting department of Stepney Municipal electrical undertaking, for conspicuous bravery and devotion to duty whilst acting as a runner during recent operations at Passchendaele.

Gunner A. W. CASS, R.G.A., was killed in action on 20th ult. He was a representative of the B.I. & Helsby Cables, Ltd., Newcastle Branch.

Private G. W. WRIGHT, Northumberland Fusiliers, reported missing, was employed at the Blackburn Corporation electricity works.

Private G. HART, of the Argyll and Sutherland Highlanders, who has died from wounds, aged 26, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Signaller W. WATERMAN, West Yorks. Regiment, who has died of wounds, was an electrician with his father at Hyde Park Road, Leeds.

Second-Lieutenant G. WOLSTENHOLME, R.F.C., is in hospital suffering from a nervous breakdown following a fight in the air. He was employed as an electrical engineer with the Rochdale Electric Co., Shawclough, Rochdale.

Private T. WALKER, of the Lancashire Fusiliers, killed in action, was employed by Messrs. W. T. Glover & Co., Ltd., Trafford Park.

Lieutenant ALEX. LAING, R.E., aged 25, whose death is reported, was employed at the Wigan Corporation electricity works, and later in the Blackburn Corporation electricity department.

Private R. H. SMITH, A.S.C. (Motor Transport), killed in action, served his apprenticeship at Canterbury with Mr. E. J. Philpot, electrical engineer.

Private J. W. MORRIS, Royal West Kent Regiment, killed in action, was at the outbreak of war engaged in Brazil with the Western Telegraph Co. He returned home to join up in June, 1915.

Corporal W. J. RUSSELL, who was with Messrs. Siemens Bros., of Woolwich, has died of wounds received in action.

Private B. PARR, N. Staffs. Regiment, reported killed after being missing, was on the staff of Messrs. Taylor & Tunnicliffe, Hanley.

Driver C. W. GARDINER, who has died of wounds, and who recently won the Military Medal for gallantry, was an electrical engineer, formerly with Messrs. C. Lee & Sons, Bath, and Messrs. Street, of Bournemouth.

Lieutenant R. C. NUDDS, R.E., who has died of wounds, enlisted at the outbreak of war from the staff of the British Westinghouse Co., Ltd., Manchester.

Private G. H. PAYTON, who was on the staff of the Midland Electric Corporation, Ltd., has fallen in action.

Captain ALDER LEWIS TRIBE, King's African Rifles, younger son of the late Mr. Alfred Tribe, F.R.S., has been killed in action.

Captain A. M. MACDONALD, M.C., Seaforth Highlanders, who has been killed, was completing a course of electrical engineering at Aberdeen when war broke out, and he enlisted.

Private F. DURMAN, an electrical engineer, formerly of Glasgow, has been killed in action.

Captain NORMAN TAYLOR (30), R.E., who has been mentioned in dispatches, was engaged with his father in the firm of Messrs. F. W. Taylor & Co., electricians, Albion Works, Milnsbridge.

Mr. J. A. Robertson, borough electrical engineer of Salford, has received information from the War Office that his son, Second-Lieutenant C. A. ROBERTSON, of the 8th Manchester Regiment, is missing. Previous to joining the Officers' Training Corps in October, 1916, Second-Lieutenant Robertson was employed in the works of the British Westinghouse Electric and Manufacturing Co., Ltd.

NEW COMPANIES REGISTERED.

H. & E. Donald, Ltd. (149,068).—Private company. Registered December 6th. Capital, £5,000 in £1 shares. To take over the business of coppersmiths, manufacturers of copper cylinders, boilers, pans, dome-topped boilers, calorifiers, cisterns, &c., carried on by H. B. Donald and E. S. Donald, at South Accommodation Road, Leeds; also to carry on the business of electrical engineers, &c. The subscribers (each with one share) are:—H. B. Donald, 82, Dewsbury Road, Leeds, coppersmith; E. S. Donald, Windsor Terrace, Garforth, coppersmith. The first directors are:—H. B. Donald and E. S. Donald. Registered office: South Accommodation Road, Leeds.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brecknell, Munro & Rogers, Ltd. (79,766).—Capital, £20,000 in 2,000 pref. shares of £5 each and 20,000 ord. shares of 10s. each. Return dated November 19th, 1917. 14,829 ord. and 1,658 pref. shares taken up; 10s. per share called up on 767 ord. and £5 per share on 1,658 pref.; £5,673 10s. paid; £7,031 considered as paid on 14,062 ord. Mortgages and charges: £7,909.

Wright & Wood, Ltd.—Satisfaction in full on November 24th, 1917, of mortgage dated August 29th, 1917, securing £520 16s.

Hackbridge Cable Co., Ltd. (146,684).—Capital, £25,000 in £1 shares. Return dated September 15th, 1917. 20,000 shares taken up; £2 paid; £19,998 considered as paid. Mortgages and charges: Nil.

Blackburn, Starling & Co., Ltd. (61,302).—Capital, £12,000 in £1 shares. Return dated July 27th, 1917. All shares taken up. £8,100 paid; £3,900 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Edison Swan Electric Co., Ltd.

The report for the year ended June 30th, 1917, states that the balance to credit of profit and loss is £34,681, from which is deducted interest on both classes of debenture stock, £15,987, leaving a profit of £18,695, plus £4,025 brought forward, leaving an available balance of £22,720, which is dealt with thus:—Munition levy to June 30th, 1916, £7,295; to write down expenses of issue of preference shares, £2,158; carried forward, £13,267. The capital expenditure during the year, before providing for depreciation, amounted to £10,900, of which £3,400 is in respect of additions to buildings, and £7,500 to plant and machinery, the latter being almost wholly for extensions to the lamp works. The profits shown in the accounts, taking into consideration the difficulties the company had to contend with during the year under review, and as were foreshadowed in the chairman's speeches when dealing with the fresh issue of capital, are as high as the directors had anticipated. The proceeds of the issue of the 100,000 preference shares shown in the balance sheet was not available for the company's business until within a few days of the close of the financial year, therefore the trading for that period received no benefit from this additional capital, whereas, as had been previously pointed out to shareholders, the lack of working capital seriously hampered the company's previous operations. Although every endeavour has been made, in entering into contracts, to provide for the increased cost of production arising from time to time by the rise in wages and cost of raw materials, it has been found impossible to synchronise the price obtainable for the company's products with the spasmodic and rapid advances in wages, over which the directors had no control, and this is reflected in the reduced gross profits earned. With the advent, however, of the new capital, enabling the company to take full advantage of discounts upon some of the raw materials purchased, which discounts are, however, now being considerably restricted, and generally to buy on better terms, it is hoped that the accounts for the current year will show more encouraging results.

The engineering side of the works has been, and still continues to be, almost wholly employed on Government orders. The output of lamps has suffered in consequence of large numbers of skilled employés, trained at the expense of the company, leaving the works to take up munition work elsewhere, necessitating the training of fresh workers. This difficulty has to some extent been overcome, and since the period covered by the accounts the output of lamps has largely increased, and manufacturing costs have been somewhat reduced.

The company's operations abroad have been much hampered by reason of the difficulties in obtaining adequate shipping frieghts, resulting in the Colonial branches not showing that expansion they would have done under normal conditions, and satisfactory profits cannot be looked for in this direction during the continuance of existing conditions.

The anticipated profits have been still further reduced, to the extent of approximately £2,500, by the fact that the company's holding in deferred shares of Altrincham Electric Supply, Ltd., has, during the past year, produced no return, that company's operations having been affected by the Daylight Saving Bill, general economics in the use of current for domestic lighting, and the high price of coal. Additional power contracts, however, have recently been entered into, and it is hoped that a fair return from these shares will be forthcoming during the current year.

There is a considerable sum due by the company for loans, which the board is anxious to reduce as early as possible, and with the commitments for munition levy, interest on the debenture stock due January 1st, and dividend on preference shares due in February, the available cash, although showing a far stronger position by reason of the proceeds of the preference share issue, will not leave more than sufficient margin to carry on the business and meet these engagements; for these reasons the directors are not in a position to recommend a dividend upon the "A" shares.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The accounts for the year ended September 30th, 1917, show, after making provision for doubtful debts and war contingencies reserve, which includes excess profits duty, a net profit of £162,149, plus £40,216 brought forward. The preference dividend absorbed £12,500, interim dividend on the ordinary shares £12,500, and there is restored to reserve fund £50,000, leaving the disposable balance at £127,336. A final dividend of 15s. per share, free of income-tax, on the ordinary shares, is recommended, making 10 per cent. for the year; £30,000 is to be put to officers' and employés' staff fund, and £59,866 is to be carried forward. At the meeting on 20th inst. shareholders will be asked to vote £30,000 towards an officers' and employés' staff fund. Col. Weston Jarvis is with H.M. Forces in France, but Capt. Nigel Hanbury is at present home for a short time on leave.

Cape Electric Tramways, Ltd.

Mr. L. Breitmeyer presided at the annual meeting, held in London on December 5th. Referring to the improvement that had taken place in traffic receipts, he said that the number of passengers carried on the Cape Town and Port Elizabeth systems was the highest on record since the flotation of the company. Unfortunately, the working expenditure was also a record, and was greatly in excess of that of normal times owing to the universal prevailing conditions—high cost of materials and wages, and the additional taxation recently imposed by the Union Government of South Africa. In Cape Town, owing to an unusually dry season, a very serious water famine was experienced, which necessitated the undue use of salt water for road watering purposes to the detriment of the permanent way, as salt water corroded the rails more than ordinary water. Fortunately their own water tank storage capacity was sufficient to supply all the water necessary for the service of the boilers during the hours of the curtailment of supply, so that no serious inconvenience was actually caused to the running of the system. The outlook for the coming year was promising, but the difficulty of obtaining supplies was still a matter of grave anxiety.

Adelaide Electric Supply Co., Ltd.—Mr. R. P. Sellon presided, on Monday, over an extraordinary general meeting at Finsbury Pavement House, E.C. He said that, as last year, owing to delays of the mails consequent upon the war they were not able before the end of the year to issue the audited accounts and hold the annual general meeting. The directors had, however, assured themselves by communication with the local directors at Adelaide, that the year's results warranted the declaration of the usual final dividend upon the ordinary shares. They had felt that it would be for the general convenience of the shareholders that that matter should be dealt with without waiting for the accounts. These had now come to hand, and it was anticipated that they would be able to hold the annual meeting early next year. He moved that a final dividend be paid on the ordinary shares of 7 per cent., free of British income-tax, making 12 per cent. for the year.—The resolution was carried.

Ross Electric Light & Power Co., Ltd.—For 1916 the gross revenue was £1,185, as against £1,315 for 1915; the expenditure was £1,144, as against £1,026, leaving a balance of £41 to be carried to net revenue. The loss brought forward from 1915 was £57, and allowing for £282 interest on temporary loans the net loss is £298. Energy sold for lighting fell 15 per cent., but to meet this to some extent the proportion of units generated to units sold was reduced. The company applied to the Board of Trade for the revision of the maximum charges for current, and there being no valid objection made, the maximum charges were raised from 7d. per unit, and for any quantity up to 20 units per quarter 11s. 8d. respectively, to 8d. per unit and 13s. 4d. per quarter. There were 155 consumers (142 lighting and 13 power) 6,089 30-watt lamps equiv.) at the end of 1916.

Barbados Electric Supply Corporation, Ltd.—The trading profit for the year ended June 30th, 1917, was £2,970, against £2,693 for 1916, and £2,231 for 1915. £495 has been charged against trading for repairs and renewals, as against £514 in 1916; this consists chiefly of the cost of replacing poles. The greater part of the work of replacement has now been carried out. The number of consumers advanced from 1,222 to 1,403 during the year, and the 25-c.p. equivalent connections from 17,489 to 19,562. In view of the difficulty of obtaining materials of all kinds, the progress is considered satisfactory. Capital expended during the year: £1,191 for further house connections and additions to mains. The loan which fell due for repayment on June 20th, 1917, has been renewed for a further five years.

Manx Electric Railway Co., Ltd.—Gross receipts for year ended September 30th, £9,573; gross expenditure, £9,625; loss, £52. Adding the debit balance brought forward £19,170, and debenture interest £9,000, there is a debit balance on revenue account of £28,222. The passengers carried were 119,683, against 111,382 in the previous year, as against between 700,000 and 800,000 in normal years. The above debenture interest has again been funded by the issue of second debentures.

Power-Gas Corporation, Ltd.—The results of trading during the year to September 30th show a profit of £21,915, plus £11,120 brought forward. Dividend 6 per cent. per annum on the ordinary shares, less income tax, £14,977; £4,380 to reserve, and £13,678 carried forward.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the quarter ending December 31st, 1917, and the third quarterly interim dividend of 1½ per cent. on the ordinary stock, free of income-tax.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended October 26th, 1917, has amounted to 2,240,246, compared with 2,038,767 units in the corresponding four weeks of 1916.

Coventry Chain Co., Ltd.—Dividend of 7 per cent. on the ordinary shares for the half-year ended August 31st last, also a bonus of 5 per cent., making 15 per cent. for the year, less tax.

British Vacuum Cleaner Co., Ltd.—Profit for the year ended September 30th, £2,095. Dividend at the rate of just over 2¾ per cent., carrying forward £1,014. There has been an improvement in the company's position during the year.

J. F. & G. Harris, Ltd.—The net profit for the year ended at June 30th, 1917, was £529. The preference dividend absorbs £282. £124 is carried forward.

Canadian General Electric Co., Ltd.—Quarterly dividend of 2 per cent. for the three months to December 31st, being at the rate of 8 per cent. per annum, on the common stock.

Hungary.—The Felten und Guilleaume Kabel, Draht und Drahtseilfabrik Gesellschaft, of Budapest, is increasing its capital from £40,000 to £120,000.

East London Railway Co.—Interest 8s. 9d. per cent., less income-tax, on "B" debenture stock for the year.

STOCKS AND SHARES.

TUESDAY EVENING.

Most markets in the Stock Exchange are dull and depressed. The principal reason is the state of affairs in Russia, with the possibility of peace negotiations between that country and Germany resulting in the release of such numbers of enemy troops as may increase the difficulties on the other fronts. Money is fairly plentiful, but there is no particular anxiety on the part of the public to invest it, and the success of the War Bonds is, of course, one of the minor factors in the situation that makes for heaviness in Stock Exchange markets. Amongst the few satisfactory spots may be counted the strength of electricity supply shares, and the firmness of the manufacturing issues as a whole, while the attractions of the good-class cable companies come more and more prominently into view as the chance of an increase in the income-tax grows stronger.

In the list of manufacturing shares, British Westinghouse Preference have fallen ½ in consequence of a few sales by holders tired of waiting for developments that do not develop. The Edison Swan report is now available, and nothing is said therein with regard to the rumours which have been current as to a possible agreement of interests amongst the manufacturers. The company has done only fairly well; gross profits show a falling-away as compared with those of the previous twelvemonth. The accounts go up to the end of June last, and the report points out that the proceeds of the issue of the 100,000 Preference shares was not available until within a few days of the close of the financial year. The directors state, however, that with the advent of this new capital, enabling the company to take full advantage of discounts and other terms, it is hoped that the accounts for the current year will show more encouraging results. As we anticipated last week, no dividend is declared on the "A" shares. The price has fallen about a florin on the issue of the report, and is now 23s. 9d. On the other hand, the company's 4 per cent. debenture stock has hardened to 75½.

The big rise in the price of India-Rubber shares which has taken place recently finds an excellent reason in the report just issued. The record for the past few years shows remarkable fluctuations. Whereas in 1913-14 there was a loss of nearly £19,000, in 1914-15 this was converted into a net profit of £80,000, which further jumped to £134,000 last year. The net profits for the year just ended are now returned at £162,000, so that in four years there is a difference of no less than £180,000 in the profits. The directors retain the dividend at 10 per cent., which is, paid free of tax, equivalent to 13⅓ per cent. under the gross rate, and they carry forward £60,000, an increase of nearly £20,000 as compared with last year. Once more the price is 5s. better at 14¾. General Electrics reacted a little to 20. Henley's have enjoyed the substantial spurt of 15s., to 16½.

The telegraph market is good throughout, Eastern Ordinary, Eastern Extensions, and Westerns with Globe Ordinary and Preference all being wanted. Eastern Telegraph has risen to 150½, "China" shares to 15, and Western Telegraph to 15¼, being what the Stock Exchange calls a good market. A dull spot is provided by Marconis, where the price of the shares has slipped back to 3¼, while Americans reacted sharply to 23s. 3d., with a subsequent rally to 24s. This fall came about on the sales by speculative buyers apprehensive of the general outlook. Other descriptions of Marconis are also a little weaker, but it is in Americans that the principal activity has occurred.

Electricity Supply shares are quietly firm. No changes have occurred in the price lists of the London companies. Newcastle-on-Tyne ordinary have gone back to a pound. British Electric Tractions are dull; the ordinary has weakened to 32½, while the participating preference keeps about 74½. Transport issues are not popular just now. Home Rails remain depressed and weary. Underground "A" shares drooped to 5s. 6d. Metropolitan Consolidated is ¼ down at 22. London & Suburban Traction ordinary changed hands at half-a-crown on Monday, the preference at 6s. 6d., and the 4½ per cent. first debenture stock at 61½. London United Tramways 4 per cent. debenture has also been dealt in this week, at 35. The last payment of interest on the stock was made nearly a year ago.

The whole of the Mexican Utility group is very flat. Mexico Tramways First Mortgage bonds have lost 7½, and the Light & Power Co.'s Firsts are 6 lower. Pachuca Fives have slumped to 32½, and the other issues of the concerns, while showing less drastic drops, are well-nigh nominal in their prices. Affairs in Mexico seem to drift from worse to worst, and the apparent hopelessness of the situation is making holders of Mexican bonds ready to sell for whatever they can get.

Brazilian Tractions keep firm, although the Rio rate of exchange is a trifle unsteady. Anglo-Argentine Trams first preference are 1/16 down; none too great confidence is felt in the chances of the next dividend being paid. Bombay Electric preference gave way ⅛, other Indian shares retaining their strength.

Babcock & Wilcox have receded along with most other iron and steel descriptions; the shares at 3 3/16 are 3/32 lower. Rubber shares are flat, on a fresh decline in the price of the produce. The various markets for tin-mining issues are better. Armaments are dull, with a few exceptions, of which Vickers stand out conspicuously. Business in most of the markets runs on very thin lines.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Dec. 11, 1917.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	6¼	—	£6 18 6
Charing Cross Ordinary	5	5	4½	—	5 17 8
do. do. do. 4½ Pref.	4½	4½	3⅞	—	6 13 4
Chelsea	4	3	2⅞	—	5 9 1
City of London	8	8	13½	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 6
County of London	7	7	11	—	6 7 3
do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	7	6	5⅝	—	5 11 7
London Electric	3	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	3½	—	5 6 8
Metropolitan	3	3	3½	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	3½	—	7 4 0
St. James' and Pall Mall	8	8	7	—	5 14 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/8	—	6 10 6
Westminster Ordinary	7	7	6⅝	—	5 5 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	96½	—	6 4 5
do. Def.	33/8	1½	26⅜	—	6 8 4
Chile Telephone	8	8	7⅞	—	5 11 4
Cuba Sub. Ord.	5	7	9½	—	*7 11 4
Eastern Extension	8	8	15	+ ½	*5 6 8
Eastern Tel. Ord.	8	8	150½	+ 1	*5 6 4
Globe Tel. and T. Ord.	7	7	10⅜	—	*5 1 10
do. Pref.	6	6	10½	—	5 17 1
Great Northern Tel.	22	24	36	— ½	6 13 6
Indo-European	13	13	52½	—	6 3 10
Marconi	15	15	3⅛	— ⅛	4 15 10
Oriental Telephone Ord.	10	10	9¼	—	3 4 0
United R. Plate Tel.	8	8	6 5/16	+ 1/16	*5 17 6
West India and Pan.	6d.	6d.	1 1/16	—	*3 9 6
Western Telegraph	7	8	15½	+ ⅛	*5 5 0
Home Rails.					
Central London, Ord. Assented	4	4	60½	—	6 12
Metropolitan	1	1	24	— ½	4 11 0
do. District	Nil	Nil	18½	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅞	—	Nil
do. do. "A"	Nil	Nil	5/8	—6d.	Nil
do. do. Income	6	4	81½	—	*4 18 2
Foreign Trams, &c.					
	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2 5/16	— 1/16	9 11 4
do. 2nd Pref.	5½	—	2⅜	—	—
do. 5 Deb.	5	5	66½	— ½	7 10 3
Brazil Tractions	4	4	46	+1	—
Bombay Electric Pref.	6	6	93	— ½	6 4 9
British Columbia Elec. Ry. Pfcs.	5	5	42½	—	11 15 4
do. do. Preferred	Nil	Nil	30	—	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	68	—	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	34½	—7½	Nil
do. 6 per cent. Bonds	Nil	Nil	33½	—1½	Nil
Mexican Light Common	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	31	—	Nil
do. 1st Bonds	Nil	Nil	34½	—6	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3 3/16	— 3/32	4 14 1
British Aluminium Ord.	7	10	1½	—	6 8 1
British Insulated Ord.	17½	20	3	—	6 13 4
British Westinghouse Pref.	7½	7½	2 1/16	— ½	5 11 4
Callenders	20	20	14½	—	6 18 0
do. 5 Pref.	5	5	4½	—	6 1 8
Castner-Kellner	22	20	3 7/16	—	5 16 8
Edison Swan, fully paid	—	—	2½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	+1	5 6 0
Electric Construction	7½	7½	1 7/16	—	6 6 4
Gen. Elec. Pref.	6	6	10½	— ½	5 14 3
do. Ord.	19	10	20	— ½	5 0 0
Henley	25	25	16½	+ ½	7 11 6
do. 4½ Pref.	4½	4½	4	—	5 12 2
India-Rubber	10	10	14½	+ ½	*5 15 7
Telegraph Con.	20	20	41½	—	*5 15 7

* Dividends paid free of income-tax.

GAS FIRING BOILERS.

BY T. M. HUNTER, M.A., B.Sc.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

(Concluded from page 551.)

Boiler Draught.—The efficiency of a boiler depends for any given combustion arrangement on two factors—the gas pressure and the chimney draught. Gas pressure regulates the quantity of gas admitted to the boiler; the chimney draught regulates the air drawn in at the boiler front, and also the speed at which the products of combustion travel through the boiler. Given a gas which does not materially change in its composition, a boiler will always give uniform results provided that the gas pressure and the chimney draught are constant. If the products of combustion travel through the boiler at a certain constant speed, the question of regulating the gas is a comparatively easy one; whereas if a boiler is joined to a stack, the question of draught is more difficult. The draught obtainable from a given stack varies with the temperature of the waste gas entering the stack and with the outside temperature of the atmosphere. For this reason the author would advocate where possible the adoption of automatic damper control, or of induced draught. With a constant draught and a constant gas pressure there should be no difficulty whatever in obtaining a constant maximum efficiency on a gas-fired boiler.

The theory is often propounded that the efficiency of a boiler increases with the velocity of the products of combustion; this theory is incorrect.

Boiler Settings.—Boiler settings sufficiently substantial to limit the conduction losses by insulating a boiler are equally necessary for coal and gas-fired boilers. It is preferable to have a poor boiler with a good setting than the best boiler with a bad setting.

The losses of efficiency by way of boiler settings are twofold—the loss through infiltration of false air into the boiler through the brickwork, and the loss by radiation and conduction of heat from the boiler out through the brickwork. As regards the entry of false air, all this air must be heated to the exit temperature of the gases. The actual heat thus carried away to the chimney is not the whole of the loss, as there must also be taken into account the loss in temperature of the flue gases when mixed with the false air. This lowers the ratio of the temperature of the gases to the temperature of the boiler tubes, and therefore reduces the efficiency of the heat exchange. The loss of efficiency by infiltration of false air is in many cases 15 per cent. or more.

The procedure in order to discover air leakages in boiler settings is very simple. If a sample of the waste gas taken at a distance of 15 ft. from the burner nozzles, or in the case of Lancashire boilers at the end of the first flue, yields a certain percentage of CO_2, the same proportion of CO_2 should prevail throughout the boiler. Should there be a decrease in CO_2, it would prove the presence of air leakages, and by taking tests at varying distances from the burner nozzles, the places where air leakages occur can be exactly ascertained. As soon as these air leakages have been found they must be stopped. The first thing to be done in such a case would be to clean the outer side of the brickwork settings thoroughly, remove all loose mortar, and repoint the brickwork. This will, as a rule, greatly improve matters, but brickwork settings have generally a very large number of small crevices which are hardly visible to the eye. In order to close these it is necessary to cover the brickwork settings with several coats of thick tar, which should be renewed from time to time until the whole of the brickwork is covered with ¼ in. layer of tar.

The losses through radiation and conduction of heat from a boiler are not sufficiently realised. When we consider that there are boilers which lose 1½ per cent. from these causes, and others which lose 15 per cent., it is evident that matters require attention. Owing to the difficulties of accurately measuring large volumes of gas in the state in which it is used for boiler firing, it is practically impossible to measure directly the radiation loss while gas firing a boiler. The usual practice is to test this loss when coal firing the boiler, and to assume that the loss is the same while gas firing. The results of a large number of tests of well-protected boilers, which were published some time ago, showed that in no case was the radiation loss over 2½ per cent.

One very common mistake, for which one has to pay very dearly, is to have boilers in the open air, and not in a boiler house. As the radiation losses are dependent on the temperature inside the brickwork, the thickness of the brickwork, the temperature on the outside of the brick, and the wind velocity, the radiation losses in the winter months, with rain and high winds, must be very much larger than in the case of summer heat. A 30 ft. × 8 ft. Lancashire boiler working continuously on gas raises steam worth over £2,000 per annum at present. It is possible in almost every case to save 5 per cent. in the radiation loss by putting a house round a boiler, saving £100 a year.

Another mistake which is very frequently made is that the brickwork is not thick enough. It is no economy to build light boiler settings, as the additional cost of heavier walls, &c., will very soon be repaid on the savings in radiation. For a Lancashire boiler in the open air, the radiation loss from the exposed front is about 1 per cent., showing a loss of £20 per annum, a sum which would pay many times for the cost of a suitable covering. As a rule, modern water-tube boilers have suitably thick brickwork settings.

In cases where it is not convenient or practicable to determine the losses of a boiler through radiation and conduction of heat by means of a careful test of the boiler with coal firing, these losses may be roughly estimated at the following figures:—

	In boiler house.	In open air.
Water tube boiler	1½ p.c. to 3 p.c.	6 p.c. to 8 p.c.
Lancashire boiler	5 p.c.	10 p.c. to 12 p.c.

Combustion.—A good combustion arrangement will give complete combustion with an excess of air of 10 per cent.; but with the usual industrial gases there are such large fluctuations in the composition and calorific value that we do not usually dare to reduce the excess of air for continuous working under 20 per cent. on account of the danger of having unburned gas in the waste gases. Good combustion can only be attained by providing an intimate mixture of air and gas. Complete combustion should take place very rapidly, at the highest possible temperature, and with the smallest possible excess of air.

Each case has to be considered in all its details. It is not always safe to say that a certain combustion arrangement will suit because it is working successfully in another plant under somewhat similar conditions.

Combustion arrangements have to be designed to suit three different conditions of gas pressure:—

1. Steady pressure of 1 in. water gauge or more.
2. Intermittent pressure, ranging constantly from 1 in. water gauge or more, to nil, with total stoppage of the gas flow and extinction of the flame.
3. Very low gas pressure, or a pressure which may sometimes be high, but is low for considerable periods.

(1) For a steady gas pressure the Bunsen type of burner gives the best results. A good burner of this type provides its own primary air, which amounts to 60 per cent. of the air necessary for combustion. The gas, acting as an injector, draws in this air, and also mixes thoroughly the air and gas before ignition takes place. Whether or not the burner is doing its duty in this respect can be tested by taking a CO_2 reading of the gas-air mixture in the burner barrel. The secondary air, which is just as essential, is drawn in by the chimney draught, in conjunction with the injector action of the mixture emerging from the burner nozzle.

The maximum flame temperature should be found in the region of the boiler within a few feet of the burner, and there should be a minimum volume of flue gases carrying away heat to the chimney. The amount of gas to be burned in a boiler is only limited by the volume of gases with which the flues can deal under the conditions of gas pressure and chimney draught. Thus the boiler output is larger than it could possibly be with a bad combustion arrangement, in addition to the efficiency being improved.

(2) Intermittent gas pressure is found at most ironworks having no gas-cleaning plant. Each time a bell is lowered to admit the charge into a blast furnace, the gas pressure drops, and usually the gas fails altogether. Ordinary Bunsen-type burners are useless under these conditions. They light back at the gas inlet inside the mixing tube, and each burner requires attention from the boilerman every time the pressure falls—say every 10 minutes—an impossible proposition. It is only very recently that this problem has been solved. Burners have been developed which draw in and mix primary air with the gas in a similar manner to the Bunsen burner. These burners work on the injector principle. Their mixing tubes are made conical, expanding in cross-section from the gas inlet to the burner nozzle. This form offers practically no frictional resistance to the flow of the mixture of gas and air. It is well known that a flame travels through a mixture of air and gas at a certain definite speed for a known mixture. The burners are so proportioned that the speed of the mixture of air and gas at the burner nozzle is greater than the speed of the explosive reaction of the flame, and therefore, when the gas pressure is present, the gas burns at the end of the burner. When the gas pressure falls the gas burns at that point where the speed of the gas-air mixture corresponds to the speed of the flame. When gas fails, the flame is extinguished, and a small coal fire is kept in the boiler to ignite the gas when it returns. As soon as gas pressure returns, the velocity of the gas-air mixture forces the flame out of the mixing tube, and combustion continues at the burner nozzle as before.

It is found that this burner automatically adjusts over considerable variations of gas pressure, the weight of primary air drawn in to the weight of gas passing on account of the absence of friction in the mixing tube. At one English ironworks, on a Lancashire boiler working at a gas pressure of about 1-in. water gauge, it is found that the temperature of the waste gases is 315 deg. C., while the temperature in neighbouring boilers fitted with the old combustion arrangement is from 700 deg. C. to 900 deg. C., with combustion still taking place at the dampers.

(3) To deal with gas at a very low gas pressure, and to get

a good mixture of gas and air, is impossible without mechanical assistance. No burner will mix them properly. A Bunsen-type burner would light back at once at such low gas pressures.

If the pressure of either gas or air is raised to 2 in. or more, the conditions are then similar to those in (1) where a steady gas pressure exists The mixing in the burner is done either by the gas or by the primary air entering under pressure; and the secondary air is drawn in at the burner nozzle as usual. To raise the gas pressure, a fan is inserted in a by-pass on the gas main, and three valves are provided to cut off the fan on each side and to close the gas main when the by-pass is open. The fan to raise the air pressure has only to deal with 60 per cent. of the air required, but an air main is required connected to each burner. Although both these methods are costly, the results, both as to additional boiler load and as to improved efficiency, are so satisfactory as to pay many times over for the outlay.

When a short, intense flame is required, we must use either air or gas under considerable pressure. This method is well known in the case of gas furnaces for reheating and melting. From 1½ to 2 lb. per sq. in. pressure on the air supply is the most suitable pressure, though excellent results are got with 12-in. (water gauge) pressure. The whole of the air needed for combustion is supplied by the mixing arrangement, no secondary air being used. The author believes that by this method, which puts the boiler under pressure, and by simply drawing off the products of combustion by the chimney draught, we should make a considerable advance in the direction of large boiler outputs combined with high efficiency.

A smaller combustion space is needed in proportion as the air and gas are more intimately mixed in the burners.

Preheated air and hot gas are of great advantage for boiler firing. Air preheated to 190 deg. C. was used at one plant, with producer gas of 150 therms per cu. ft. The sensible heat of the air added 5 per cent. to the calorific value of the gas, and thus raised the flame temperature. It depends upon where the heat is got, whether it really adds anything to the total efficiency. If the air or gas is heated by waste gas, say in an economiser or in passages outside the walls of the boiler, the heat then supplied is all clear gain.

Gas Measurement.—If the evaporation of a boiler is known, the only other thing required is to know the quantity of gas consumed. Here a serious difficulty arises. Wherever a large quantity of gas is concerned, gas measurements are difficult, and where the gas is of high and varying temperature and carries a large quantity of dust, they are next to impossible. Velocity measurements, with the assistance of the Pitot tube or throttling disk, or anemometer, cannot be trusted to give absolute readings, but they are very effective in giving readings which are relatively correct from day to day. To obtain the actual values there is no other way but to resort to theoretical calculation, and to draw up a balance-sheet for the carbon.

A meter of the rotary type should be calibrated by means of a gasometer, both before and after use, with the actual gas it is measuring. If this is not done, large errors may arise. With Pitot tube meters, the Pitot tube must be kept clean, and should be examined and blown out at short intervals. Meters working by the difference of pressure on the two sides of a throttling disk in the gas main are less apt to deceive than Pitot tube meters, because they are not so liable to be affected by eddies in the gas flow. Velocity readings should never be used unless the pipe in which they are taken is straight for about 10 diameters' length on each side of the point of reading. The author has used both Pitot tube and throttling disk gas meters at several different plants, and on the whole has had reason to be satisfied with the readings they gave of relative volumes.

Boiler Control.—There are three methods by which we can test what results are being got by a boiler, namely, (1) by measuring the gas supplied and the water evaporated, (2) by analysing and taking the temperature of the waste gases, as described above, and (3) by taking the combustion temperature. All these methods are good. The chemical method is slower and more laborious than the pyrometer method, but it is cheaper and gives much more information.

For testing the combustion temperature a pyrometer junction is inserted in each boiler flue within a short distance of the nozzle of the burner. All these junctions can be wired to one dial, with switches to connect each junction in turn to the dial. Such an arrangement is especially desirable if the engineer in charge has no time to be constantly at the boiler plant. He can have the dial in his office, and can at any moment read the temperature in front of each burner nozzle, and give instructions to the boilerman to attend to such burners as are not working satisfactorily.

A CO_2 recorder on the boiler flue is an excellent check on the results. It will be realised, however, that very deceptive deductions may be made from the readings of this instrument. Although the CO_2 reading is good, there may be unburned CO present, causing serious losses. If an instrument were fitted to record CO_2 and CO simultaneously, it would be the ideal arrangement for the chemical control of gas-fired boilers, and the author sees no reason why such an instrument should not be made and sold at a reasonable price.

A gas-pressure gauge should be fitted, if not at each boiler, at least at every range, in a place easily seen by the boilerman. In addition, a differential draught gauge should be fitted to each boiler, showing the difference in draught between the front and back of the boiler, and a plain mark should be made on the dial at the reading which the boilerman is to maintain by means of his dampers. With these gauges it is an easy matter to instruct a boilerman how to control his burners without trusting alone to the appearance of the flame, even under varying conditions of gas pressure and chimney draught. On large boilers working at steady gas pressure it pays well to install automatic damper control to maintain a uniform chimney draught.

Water meters are a necessity for careful boiler control. At least one meter to every range of boilers is necessary. Gas meters should also be installed.

In all large works a man should be appointed to take general charge of the steam output. He need have no great chemical or engineering training, as his business is simply to run his boilers at their maximum efficiency, and all engineering matters would be reserved for the engineer or manager. A suitable man can be got for £4 a week in ordinary times, but of course he would require a little training from a chemist or engineer before he fully understood his duties. The author has trained one such man, and found that he picked up the requirements very quickly and carried out his duties most successfully. At a works raising 100,000 lb. of steam per hour the value of the steam is about £40,000 per annum. If the man in charge of the boilers, by his effective control, improves the efficiency by only 5 per cent., the £2,000 saved will pay his salary many times over. In addition, there is the advantage that the maximum possible supply of steam will always be secured. Even with the best combustion arrangements, the result of intelligent control will be a saving of at least 5 per cent. as compared with the results to be attained with the same installation run simply by boilermen, so that there is no possible excuse for a company that neglects to appoint such a man. In large American works the steam engineer is a recognised necessity, and he is a highly paid official.

The best outfit of recording instruments is useless unless a constant and intelligent use of them is absolutely enforced. All the temperatures, pressures, volumes, and analyses taken should be entered up in a special book. At least once a week a balance-sheet should be drawn up, showing the allocation of the gas to each part of the work and the results obtained therefrom. This should be submitted to the manager weekly, with the necessary explanation in case any result falls short of the required efficiency. If, in addition to this, the boilermen and the man in charge of the boiler plant are given a premium for maintaining good results, boiler control will soon develop into a fine art, and prove an important source of revenue.

PYROMETERS AND PYROMETRY.

Discussion at the Faraday Society's Meeting.

(*Concluded from page 534.*)

Applications of Pyrometry to the Metallurgy and Heat-Treatment of Steel.—A group of papers, and as many speeches, dealt with this important aspect of the subject. Whatever may in the future be the outcome of some of the newer methods of measuring high temperatures already referred to, at present the various forms of optical pyrometers hold the field—not without a good deal of unfriendly criticism—for taking the temperature of molten steel. If the contention of Dr. W. Rosenhain proves to be correct, that the future must lie with a pyrometer the sensitive members of which are outside the furnace, this must always be the case, but it is well not to dogmatise on the future. Mr. J. A. Rhodin's view was that the optical pyrometer was essentially unsatisfactory, on account of the personal equation involved. The truth appears to be that this type of instrument is capable of extraordinary accuracy if it is used by carefully-trained observers and under proper conditions, namely, "black body" conditions, or the necessary corrections made if these be imperfectly fulfilled. The optical properties of the glass for the eyepiece was not to be lost sight of, Dr. J. A. Harker reminded the meeting. These are fairly simple qualifications, and yet it would seem, judging from many speakers, that they are not clearly grasped even by expert users of pyrometers. One of the most fruitful results of the discussion should be to emphasise the care with which pyrometers have to be used—especially for temperatures above 1,500 deg. C.—and their readings interpreted. As to their limits of accuracy, Mr. Cosmo Johns actually talked of variations of ± 2.5 deg. C. in readings taken at some 1,600 deg. C., and Prof. J. O. Arnold, F.R.S., using, in a particular series of experiments, five different types of pyrometer (the Féry thermoelectric radiation, the Féry bimetallic spiral spring, the Foster base-metal thermocouple, a modified Wanner radiation, and a Mésure and Nouel radiation pyrometer), and employing different observers, arrived over a wide series of readings at a grand mean temperature of 1,296 deg. C., when 1,300 deg. C. was the temperature aimed at.

Both Mr. Cosmo Johns (Sheffield) and Dr. A. McCance (Glasgow) spoke on temperature determinations of liquid steel. Dr. McCance has now evolved a system under which nearly 12,000 determinations are made in the course of the year, using the Siemens optical pyrometer. His experience was that frequent standardisation was necessary, but if the proper precautions were taken, the apparent temperature of the slag surface could be kept constant between 1,630 deg. and 1,650 deg. C., to the great advantage of the furnace lining. The true temperature would be the apparent temperature less an amount depending on the temperature of the flame and the emissivity of the slag. The true temperature of liquid steel he considered to be 1,600 deg. C., and castings below this gave cold heats. Dr. W. H. Hatfield (Sheffield) found a disparity as great as nearly 200 deg. C. between the readings of the temperature of molten steel by a thermo-couple and the Cambridge optical instrument, due, of course, to imperfect black-body conditions. Both Dr. Hatfield and Dr. McCance had much to say which was of great interest as to the practical precautions to be taken in work of this kind, for which reference must be made to the full report of the discussion that will be published in due course. The bearing of the emissivity of the molten metal surface on optical pyrometer readings was discussed in some detail by Prof. F. G. Donnan, F.R.S. (University College, London), who showed curves and tables giving the necessary corrections in the case of gold, silver, and copper. It would be very useful if similar curves could be obtained for iron, steel, and molten slags. Mr. Cosmo Johns gave the results of his experiences of temperature measurements of molten steel, taken with optical pyrometers using monochromatic light, a system that had been in regular works practice for nearly four years. It appeared that skilled observers were able unaided to distinguish differences of 15 deg. C. when steel was flowing into a ladle, and 10 deg. when running into an ingot mould, so that any system of pyrometry called for an accuracy of ± 5 deg. C. More than this was attainable by trained observers if standard conditions of observation were adopted. Mr. Johns proceeded to state these conditions, both as regards the proper part of the stream to observe and the relative time of observation, seeing that the temperature of a flowing stream was bound to be either rising or falling. Observations on the temperature of the interior linings of furnaces after the steel had run out were of considerable interest as bearing on the softening or fusion range of the refractories employed. Under proper conditions, every detail inside the furnace was visible: joints in the brick work, junctions of sand banks with the side walls, port openings, and places where wear had occurred could all be perceived. A research on the emissivity of silica bricks at steel-furnace temperatures was called for. Dr. McCance's experiences agreed closely with those of Mr. Johns.

The application of pyrometry to the hardening of high-speed tools was discussed by several speakers, notably by Prof. J. O. Arnold. At Sheffield University the practice is to immerse the tool in a bath of barium chloride fused by a current which passes into it through iron electrodes. Perfect regularity of temperature is attained, 1,300 deg. C. being the point aimed at. Mr. P. Peakman (Manchester) keeps a temperature record of his hardening furnace by inserting a thermocouple into the bottom or side of the furnace. The readings of this being standardised it acts as a check, and it is unnecessary to take the actual temperature of the high-temperature zone. For the calibration of thermocouples he suggested, incidentally, to use a piece of steel of known transformation point. Mr. W. Carter voiced the opinion of many users when he urged the use of two kinds of pyrometers, a rough type for works use and a laboratory type for checking.

Pyrometry in Glass Making.—Some interesting remarks on this side of the subject were made by Mr. C. J. Peddle (Sheffield). In the glass industry the value of scientific pyrometry was just beginning to be appreciated. He advocated the use of optical pyrometers, first, because in a glass tank one had almost ideal "black body" conditions, and secondly, because thermocouples could not be inserted in the glass, and even in the roof their life was likely to be short. He saw no reason why the monochromatic glass required for optical pyrometers should not be made here. The instrument makers had only to specify exactly their requirements, and he felt sure the glass makers could discover a suitable glass.

The Measurement of High Temperature by Means of Pottery Materials.—Under this title Mr. H. Watkin, of Stoke-on-Trent, contributed what was perhaps one of the most interesting papers in the symposium. Unfortunately, metallurgy monopolised the field so long that it was nearly 10.30 p.m. before the Chairman was able to call upon Mr. Watkin, and his paper passed as read without discussion. The relation of temperature to degree of firing lies at the foundation of the work of the potter, and it is therefore not surprising that he has for long estimated his temperatures by their effect on his clays. Mr. Watkin tabulates these methods of ascertaining high temperatures as follows:—

1. By sight—by the colour of the oven's contents.
2. By the changes red clays undergo when heated.
3. By the translucency of certain trial pieces.
4. By the development of the rose-tint in enamelling colours.
5. By measurement of bulk or contraction.
6. By the feel or touch.
7. By the sense of hearing—judging of the sound when the ware is struck.

None of these time-honoured methods, however, are up to modern requirements, and they have been modified in the direction of greater sensitiveness, reliability, and constancy. The most famous of these improvements was the invention of the Segar cone in 1886, when Segar made up a series of cones having melting points from 1,150 to 1,390 deg. C. A still further use of the same principle has been made by Mr. Watkin in his "heat recorder," which consists of a block of very refractory ware with five circular recesses sunk into its top face. In these recesses are placed little pellets of fusible materials of definite composition and melting-point. The fusion-point of each mixture has been carefully determined by comparison with a standard electrical pyrometer. The pieces that become fused are attached to the recorder, and the heat attained is thus definitely registered. These recorders have been found useful in many industries, as in pottery and porcelain manufacture, brick-making, gas works, glass works, and for numerous processes of annealing. The method seems to be unknown outside the pottery industry, and it is, therefore, well that it has had an opportunity to be brought before a wide public, for its simplicity—the absence of any measuring instrument—may render it useful in many an unsuspected direction. It must, of course, not be forgotten, as Mr. W. J. Rees (Sheffield) pointed out in a written communication, that all such methods measure not temperature, but heat-effect, and that the rate of heating has to be considered as well as the temperature attained. For firing pottery or burning refractories it is the amount of shrinkage which is of importance; nevertheless, as Major C. W. Thomas pointed out (also in a written communication), to enable the worker perfectly to control his process he needs to watch the progress of the shrinkage. It ought to be considered whether any method is capable of giving this information short of a recording instrument. This, however, is for the refractory maker to decide.

Exhibits.—A large number of exhibits, comprising probably every type of pyrometer now on the market, added considerably to the interest and usefulness of the meeting. Among the English instruments were to be seen those made by the Cambridge Scientific Instrument Co., the Foster Instrument Co., Mr. R. W. Paul, and Messrs. Siemens Bros. & Co., Ltd. Messrs. Hadfields, Ltd., showed a Harker electric furnace used for standardising optical pyrometers, and also a Brown furnace control pyrometer. Mr. Watkin illustrated his paper with a range of pottery temperature indicators and other specimens, and Mr. G. E. M. Stone showed his base-metal pyrometer referred to in his paper, and also some very instructive examples of faults which pyrometers are prone to develop. The Automatic Electric Furnaces, Ltd., showed the Wild-Barfield furnace for hardening gauges and tools.

ELECTRICITY IN COAL MINING.

At a meeting of the North of England Branch of the Association of Mining Electrical Engineers, at Newcastle-on-Tyne, on November 24th, Mr. C. A. Nelson, the new President, delivered an address. He said there was no mining district in Great Britain which had the electrical advantages of Northumberland and Durham. They had at their call one of the largest electricity supply undertakings in the Kingdom, which, on account of its size, could offer energy to its consumers at a price per unit that no individual colliery could generate at, unless it had some special advantage. Practically all the Northumberland pits would finally find it to their advantage to take current from this source. During the last six years he had been constantly engaged in substituting electrical for steam plant. The first steps were directed to cutting off the low-pressure boilers, and the inefficient engines working from them. In each case comparative prices and costs were taken of up-to-date steam plant and electrical plant, and it was found in most cases that the electrical plant had the advantage. In comparing the cost of electricity taken from a supply company with that of steam plant, colliery engineers were apt to err in favour of the latter, and he had found by experience that depreciation and maintenance charges for steam plant were much under-rated. For instance, it was wrong only to take the cost of coal used, plus cost of firemen, and repairs and depreciation of boiler plant; they should allow for depreciation, maintenance, and repairs on steam and water-pipe ranges, boiler pumps, joints, special railway sidings, wagons, and bunkers, and, in addition to firemen's wages, their compensation, insurance, house and coals; for the locomotive, the driver and the shunter, as well as for a part of the agent's, manager's, engineer's, and engine-wright's time. The cost of the water supply also was often omitted from the estimate, as well as the cost of dealing with the ashes. As all these things were eliminated by taking current from a supply company, they should be charged against steam. At the actual machinery, there was a considerable saving in oils, packing, grease, &c. In elec-

trical winding he had also found there was a saving in wear and tear on the ropes and cages; and the maintenance cost of the shaft guides, conductors, &c., was reduced by reason of the smoother working. The maintenance of plant when electricity was used was reduced to a minimum, and a point of great importance was its efficiency. A steam engine might work inefficiently for weeks without the engineer being aware of the fact, whereas, with electricity, it was at once apparent on the meters, and could be attended to immediately. The efficiency of electricity, and its elasticity of application, would practically lead to its gradual replacement of all other power, and the sooner this was realised the sooner we should be able to overcome successfully international competition. The industrial development of this country was intimately connected with the development of the use of electric power. Large central supply stations efficiently managed could, owing to the diversity of their loads, do more to help this industrial development forward than any individual. The plant installed at the Wallsend and Hebburn Collieries was of approximately 13,000 B.H.P., and the energy used was 11,000,000 units per annum. They had two large direct-coupled winders, duplicates, and a third was being installed. The motor was 730/1,950-B.H.P., three-phase induction type, wound rotor and slip rings, 50 R.P.M. They lifted from 60 to 72 cwt. of coal per wind, and the units used were 5.7 per wind, the shaft being 1,080 ft. deep. The winders were built by the British Westinghouse Electric & Manufacturing Co., Ltd. Although the old steam winder had a 22-ft. drum, and the electric winder only 12 ft., the life of the rope had increased from two years one month, to three and a half years, when they had to remove it to comply with the Coal Mines Regulation Act, and, as the rope was in excellent condition when taken off, they had decided to apply to the Inspector of Mines to get the regulation time extended in favour of electric winders. It was in underground haulage that electricity, owing to the intermittency of the work, and the distance from its source of power, showed the greatest advantages. For the main haulages it was ideal, and when taken underground it obviated the abomination of a running set of ropes in the shaft, or, the alternative, pipes. For secondary haulages electricity had also great advantages. He had found that for large main and tail haulage gears, the liquid type of controller, with reversing switches, was the best. They had carried out an interesting change by arranging an independent system of ventilation for each colliery at Wallsend, whereby an hourly consumption of 366 units had been reduced to 92.83, a saving of 273.17 units, equal for a year to 2,392,940. The application of electricity to fan drives, with the motor connected directly to the fan, was attended with difficulty owing to the speed of ordinary motors being constant; to overcome this, they were installing a 150-H.P. adjustable-speed polyphase induction motor with seven speeds—260, 300, 340, 400, 480, 600, and 800 R.P.M. If successful, this would allow them to run the fan at a speed which was just enough to give an adequate ventilation, and would allow of easy change in speeds to suit the week-ends and holiday arrangements. The pumping and air compressing was almost entirely driven by electricity, as was the machinery for the screens and shops. At present they were using about 1,000 miners' lamps of the C.E.A.G. type, and, although more expensive in first cost and maintenance, these had in use justified themselves; but he considered there was a great future for a good dry-cell miner's lamp.

Mr. NELSON is the agent of the Wallsend and Hebburn Collieries, Ltd.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

17,396. "Operating water-tight electric switches." E. H. KEELEY. November 26th.

17,397. "Mechanical cut-in and out for electrical charging sets." C. L. G. CHAPMAN & E. SMITH. November 26th.

17,398. "Electrical connections of electric torches, &c." EFANDEM CO. AND A. H. WILLIAMS. November 26th.

17,410. "Electric ignition torch." A. E. LONG & H. SEAL. November 26th.

17,416. "Sprocketed tilting trunnions and gear for electric tilting furnaces, &c." J. H. TWIDELL. November 26th.

17,426. "Electro-pneumatic braking apparatus." W. V. TURNER. November 26th. (U.S.A., June 50th.)

17,431. "Electric cables." W. T. HENLEY'S TELEGRAPH WORKS CO. & H. SAVAGE. November 26th.

17,450. "Electric switches." G. TUA. November 26th. (Italy, April 4th.)

17,493. "Electric hand-lamps." M. EDWARDS. November 27th.

17,508. "Insulator." A. E. Y. TRESTRAIL. November 27th.

17,511. "Signalling generators." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) November 27th.

17,517. "Electric heating elements." H. J. DOWSING & DOWSING RADIANT CO. November 27th.

17,525. "Electric telephony." P. S. GOMEZ. November 27th.

17,529. "Vacuum electric discharge devices." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) November 27th.

17,533. "Lamps for divers." C. DOBELL & A. WOOSNAM. November 27th.

17,590. "Torches for welding and cutting metals, &c." B. CONKLIN. November 28th.

17,608. "Automatic telephone systems." AUTOMATIC ELECTRIC CO., AUTOMATIC TELEPHONE MANUFACTURING CO. & A. J. RAY. November 28th.

17,612 & 17,628. "Electric furnaces." E. GRAMMONT. November 28th.

17,617. "Receiving or detecting apparatus for sound, &c., waves." S. G. BROWN. November 28th.

17,648. "Electric switch and dimmer. F. M. T. EVANS. November 29th.

17,673. "Electro-magnetic devices, &c." G. PLAISANT. November 29th.

17,674. "Spintherometers for use in wireless telegraphy." A. MARINO. November 29th.

17,675. "Commutators for dynamos or motors." H. C. H. SMITH AND TREDELECT ENGINEERING CO. November 29th.

17,679. "Electric switches." E. A. NEW. November 29th.

17,690. "Electrically-operated riveting, pressing, stamping, &c., machines." E. ADAMSON. November 30th.

17,700. "Electric furnaces." J. GAINS, A. HALL & F. MOODY. November 30th.

17,745. "Electric torches." A. FLEMING. November 30th.

17,751. "Regulating mechanism for dynamo-electric machines." BRITISH THOMSON-HOUSTON CO. & F. H. CLOUGH. November 30th.

17,762. "Submarine signalling apparatus." C. S. BOOKWALTER & F. A. DAUBIN. November 30th.

17,769. "Flash lamps." BRITISH EVER-READY CO. & M. GOODFELLOW. November 30th.

17,772. "Alternating-current rectifiers." C. J. QUELL. November 30th.

17,773. "Automatic signalling arrangements for electric tramways, &c." D. HAMBURG. November 30th.

17,775. "Dynamo-electric machines." S. F. BARCLAY & VICKERS, LTD. November 30th.

17,776. "Gyro compasses." S. G. BROWN. November 30th.

17,788. "Electric switches." A. TURNER & R. H. WILKINSON. December 1st.

17,801. "Joints for electric welding on thin material." F. BLOMLEY. December 1st.

17,802. "Electrical ignition apparatus for internal-combustion engines" J. H. CHAMBERS & H. LUCAS. December 1st.

17,823. "Starting mechanism for magnetos of internal-combustion engines" L. JOHNSON & J. T. ROBERTS. December 1st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

16,107. IGNITION AND LIGHTING APPARATUS FOR AUTOMOBILES. Girardeau. November 16th, 1914.

1916.

10,882. DYNAMO-ELECTRIC MACHINERY. Electromotors, Ltd., B. Longbottom and E. Greenhalgh. August 2nd, 1916. (Patent of addition not granted.) (110,916.)

11,503. ELECTRIC CABLE CONNECTING BOXES, FUSE SWITCH BOXES, DIVIDING BOXES AND THE LIKE. British Insulated & Helsby Cables, Ltd., and R. W. Blades. August 15th, 1916. (110,919.)

15,675. WIRELESS TELEPHONE SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.) November 2nd, 1916. (110,924.)

15,840. SUBMERSIBLE VESSELS. G. F. Myers. November 6th, 1916. (Divided application on 16,600/15.) (110,928.)

15,842. SUBMERSIBLE VESSELS. G. F. Myers. November 6th, 1916. (110,929.)

15,843. SUBMERSIBLE VESSELS. G. F. Myers. November 6th, 1916. (110,930.)

15,867. PRINTING PRESSES. Goss Printing Press Co. of England (Goss Printing Press Co., U.S.A.). November 6th, 1916. (110,932.)

15,963. THERMOSTATS. H. H. Grundy. November 7th, 1916. (Addition to 5,311/12.) (110,938.)

16,215. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. H. G. Longford, W. W. Longford & W. A. Clark. November 13th, 1916. (Cognate application, 17,885/16.) (110,950.)

16,516. CENTRIFUGAL COMPRESSORS. British Thomson-Houston Co. (General Electric Co., U.S.A.) November 17th, 1916. (110,957.)

16,591. TWO-WAY MASTER SWITCHES FOR ACTUATING SETS OF CONTACTOR SWITCHES FOR REVERSING MOTORS OF PLANING MACHINES AND OTHER RECIPROCATING MACHINES. G. Stirk, E. Stirk, R. Stirk & J. G. Stirk. November 20th, 1916. (110,958.)

16,990. ELECTRIC TRACTORS. E. C. R. Marks (Mercury Manufacturing Co., U.S.A.). November 27th, 1916. (110,968.)

17,111. SOLENOID MOTOR. G. Henwood & J. Lane. November 29th, 1916. (110,969.)

17,598. DEVICE FOR TESTING THE PITCH OF A SCREW. H. W. Pugh & C. H. Vidal. December 7th, 1916. (110,976.)

17,981. METHOD OF CONTROLLING AND APPARATUS FOR PRODUCING ELECTRIC ARCS. D. F. Comstock & Technicolor Motion Picture Corporation. December 14th, 1916. (110,982.)

1917.

253. WELDING OF TUBES TO PLATES. T. E. Murray. February 12th, 1916. (107,194.)

528. ELECTRIC WELDING MACHINES. T. E. Murray. March 6th, 1916. (104,675.)

1,285. HEATING DEVICE FOR MOTOR CARS. Jandus Arc Lamp & Electric Co. and A. Denman-Jones. January 25th, 1917. (111,003.)

1,482. ELECTRIC DRY CELLS. F. R. Tammadge & F. C. Tammadge. January 30th, 1917. (111,005.)

2,383. ANEMOMETERS. South Metropolitan Gas Co., E. V. Evans & J. S. G. Thomas. February 17th, 1917. (111,015.)

3,485. ELECTRIC WELDING OR FUSION DEPOSITION OF METALS. Quasi-Arc Co. & L. Tweedale. March 9th, 1917. (111,026.)

3,546. APPARATUS FOR TEACHING SIGNALLING IN MORSE OR OTHER CODES. F. W. Green. March 10th, 1917. (111,027.)

4,555. ENGINE STARTER. V. Bendix. March 29th, 1917. (111,039.)

5,028. LIGHT PROJECTION APPARATUS. A. Ames. December 6th, 1916. (Divided application on 17,522/16.) (111,041.)

5,244. ENGINE STARTER. F. B. Dehn (Eclipse Machine Co., U.S.A.). April 13th, 1917. (111,042.)

8,589. ELECTRIC BATTERIES OR CELLS. I. Cassan. June 15th, 1917. (111,058.)

9,405. INTERRUPTING DEVICES FOR THE IGNITION OF INTERNAL-COMBUSTION ENGINES. O. Imray (R. Bosch). June 29th, 1917. (111,062.)

11,665. TELEGRAPH SYSTEMS. Automatic Telephone Manufacturing Co. and H. H. Harrison. August 1st, 1917. (110,730.)

11,236. IGNITION DYNAMOS. C. T. Mason. September 15th, 1916. (109,794.)

11,358. MEANS FOR CONTROLLING ELECTRIC CIRCUITS. W. O. Kennington. August 7th, 1917. (111,071.)

11,878. TELEGRAPH SYSTEMS. Automatic Telephone Manufacturing Co. and H. H. Harrison. August 18th, 1917. (110,733.)

12,278. SPARK PLUGS. E. C. R. Marks (La French Power Spark Plug Co.). August 27th, 1917. (111,073.)

14,831. PRINTING PRESSES. Goss Printing Press Co. (Goss Printing Press Co., U.S.A.) November 6th, 1916. (Divided application on 15,867/16.) (111,076.)